RTCA, Inc.
1140 Connecticut Avenue, NW, Suite 1020
Washington, DC 20036-4008 USA

MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR THE MODE S AIRBORNE DATA LINK PROCESSOR

RTCA/DO-218B
June 12, 2001
Supersedes DO-218A

Prepared by: SC-187

Copies of this document may be obtained from

RTCA, Inc.
1140 Connecticut Avenue, NW, Suite 1020
Washington, DC 20036-4008 USA

Telephone: 202-833-9339
Facsimile: 202-833-9434
Internet: www.rtca.org

Please call RTCA for price and ordering information.

FOREWORD

This report was prepared by Special Committee 187 (SC-187). It was approved by the RTCA Program Management Committee (PMC) on June 12, 2001, and supersedes RTCA/DO-218A, *Minimum Operational Performance Standards for the Mode S Airborne Data Link Processor,* issued July 29, 1999.

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1 INTRODUCTION

1.1 Document Purpose

This document sets forth minimum operational performance standards for the Mode S Airborne Data Link Processor (ADLP). The ADLP provides a standard communication interface through which avionics application processors may exchange data with ground-based application processors via the Mode S transponder. Compliance with these standards is required to assure that the Mode S ADLP will perform its intended functions satisfactorily under normal operating conditions. Incorporated within these standards are system characteristics that will facilitate the design and implementation of the Mode S ADLP.

Since the equipment implementation includes a computer software package, the guidelines contained in RTCA/DO-178B (Ref. 1) should be followed.

1.2 Document Scope

This document defines the functional requirements for the Mode S ADLP, and describes the aeronautical architecture within which the Mode S ADLP will operate. It does not define data link applications that will be supported by Mode S and other data links.

Chapter 1 provides an overview of the data communication environment in which the Mode S Airborne Data Link Processor is expected to operate, and the role that the Mode S ADLP plays within this environment.

Chapter 2 provides performance requirements for a Mode S Airborne Data Link Processor. The chapter is organized to parallel the major functions of the Mode S ADLP. Chapter 2 concludes with test procedures for verification of Mode S ADLP conformance with the functional specification.

1.3 Mode S Data Link Operational Goals

The operational goals of the Mode S Data Link system design may be summarized as follows:

a. Provide Air/Ground Data Transfer for Air Traffic Service (ATS) Applications.

b. Conform to Aeronautical Telecommunication Network (ATN) Architecture.

These goals are achieved in the Mode S Data Link system design described within this document.

1.4 Aeronautical Data Communication Environment

An internetwork architecture, composed of multiple interoperating networks, offers the greatest flexibility in design, management and control of each independent network. The internetwork architecture also allows each network to be optimized for use in its own environment. The alternative (i.e., one unified network encompassing all airborne and ground processing) would impose an unnecessarily high degree of standardization and present formidable management problems. This would be especially undesirable in an environment where various avionics application processors need to exchange data with various ground-based application processors, all operated and controlled by different authorities and organizations.

The aeronautical data communication environment illustrated in Figure 1-1 may be described as an *internetwork* architecture. In this figure, the communication networks are represented by circles and the application processes connected by the networks are represented as boxes.

Data transfer through an aeronautical *internet* (i.e., internetwork environment) is supported by three types of data communication networks:

a. Avionics Networks.

b. Ground Networks.

c. Air/Ground Networks.

The transfer of data between two *end users* (i.e., application processors) of the aeronautical data communication system is accomplished through the interconnection of these networks in a manner providing a continuous path between the respective end users.

1.4.1 Avionics Networks

Some aircraft will incorporate one or more internal networks that interconnect the various processors required for the operation of flight systems. These are referred to as *avionics networks.* In an aircraft equipped for aeronautical data communication, these networks are used to interconnect the aircraft data communication processors (such as the Mode S ADLP) with aircraft application processors (such as data display processors, data entry processors and flight management computers).

In the simplest (i.e., single air/ground network) case, an aircraft application processor may be connected directly to a dedicated data communication processor. Where internetwork operations are desired, each aircraft application processor may have access to one or more data communication processors, and thus to their respective air/ground networks.

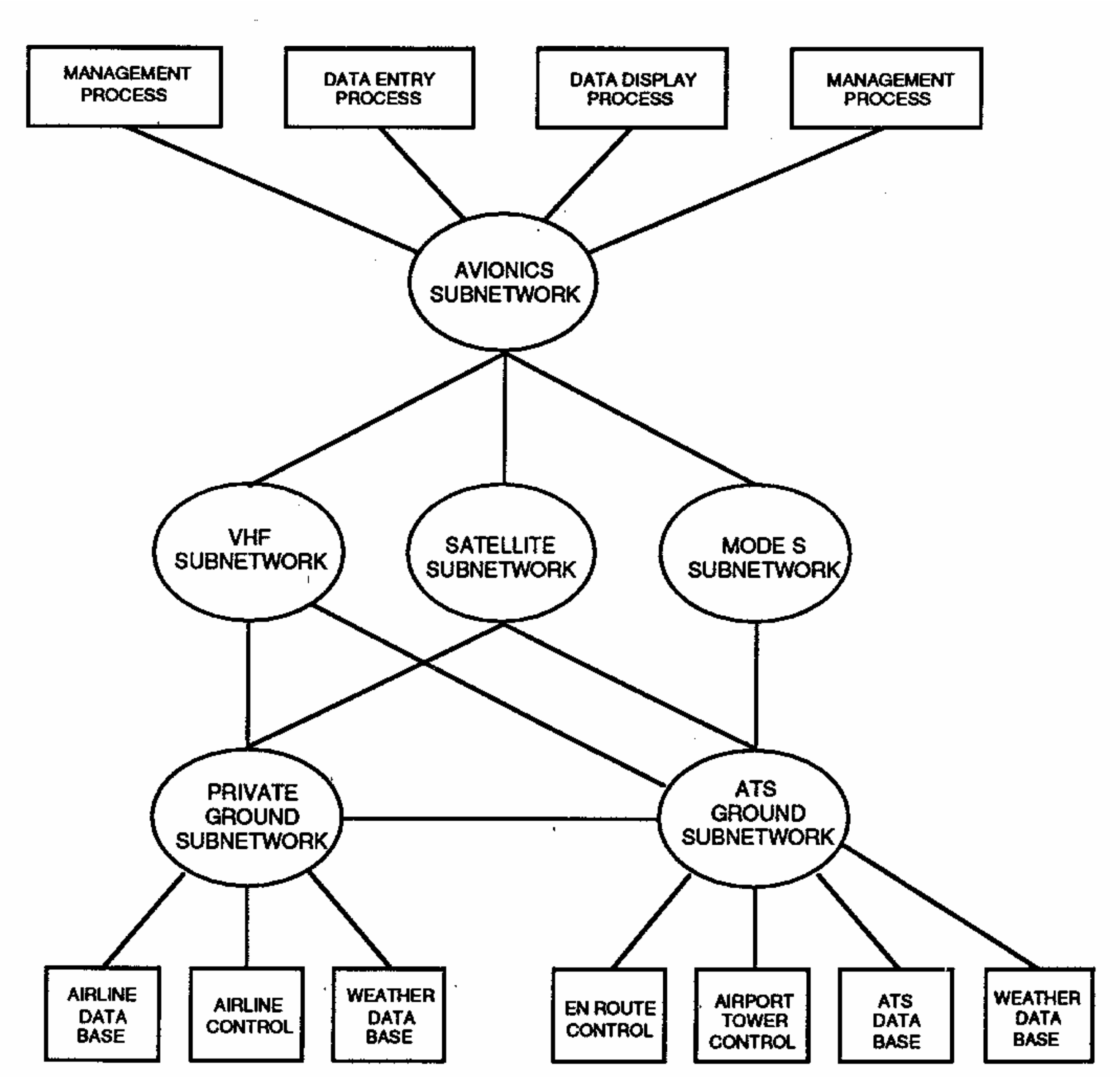

Figure 1-1 Aeronautical Telecommunication Network Environment

1.4.2 Ground Networks

Ground-based data processing facilities require a similar level of connectivity among the various processors local to that facility. A *ground network* provides the required connectivity within such a facility, often in the form of a local area network (LAN). The ground networks also provide interconnection of ground application processors with ground data communication processors (e.g., the Mode S Ground Data Link Processor), in order to access the aircraft-resident end user.

In the case of Air Traffic Service facilities, the various ground networks will generally have differing physical and logical characteristics while serving the common purpose of connecting the various ground application processors. These application processing systems may incorporate meteorological processors, air-route traffic control processors, flight service processors and airport tower control processors.

The Air Traffic Service facilities will generally be interconnected via interfacility ground networks, and as Figure 1-1 illustrates, other data networks may also be interconnected with ATS ground networks.

1.4.3 Air/Ground Networks

An *air/ground network* serves to interconnect end users of ground networks with end users of avionics networks. The air/ground network performs this function by transferring messages to the destination avionics network from the originating ground network, and by transferring messages from the originating avionics network to the destination ground network.

The Mode S Data Link is one of several air/ground data networks serving the mobile aviation end user. Figure 1-1 illustrated two other networks, a VHF data network and a satellite data network. As shown in Figure 1-1, an air/ground network may interconnect with ATS ground networks, as well as with other ground networks.

1.4.4 Interconnection of Networks

For messages to be passed between the ground and avionics networks through the air/ground network, there must be a clearly defined transition from one network to another. This transitional element is known as a *router*.

The interconnection of networks that are physically, logically or administratively separate is performed through the installation of routers at the points of interconnection. Figure 1-2 illustrates how the networks of Figure 1-1 are interconnected by routers.

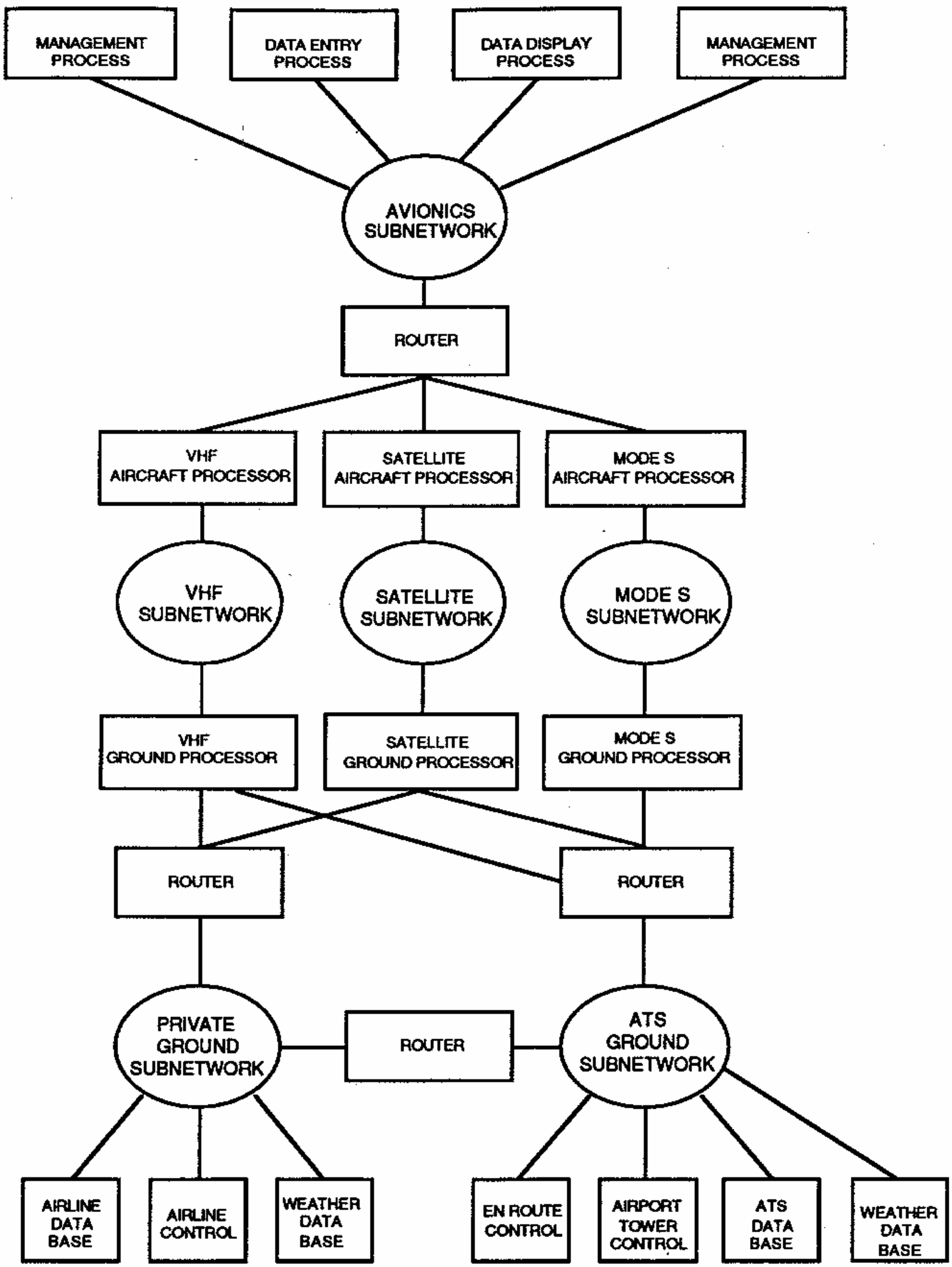

Figure 1-2 Network Interconnection with Routers

The term "router" in this document refers to the communication element that manages the information flow between the ground network and the air/ground network, and between the air/ground network and the avionics network.

1.4.5 Internetwork Requirements

To realize the advantages of an internetwork architecture, techniques for transfer of messages among participating networks must be independent of protocols and addressing schemes unique to any one participating network.

The requirements placed upon networks participating in an internetwork environment may be summarized as follows:

a. All participating networks have routers, which utilize a common *internetwork protocol* standard.

b. All participating networks must utilize a common *global addressing* standard.

c. All networks must carry the internetwork router protocol and global address in a transparent fashion.

A common internetwork protocol standard, accompanied by a universally comprehensible global addressing plan, provides a network-independent interface to the end user. Messages that pass between networks must contain global address information defining the message source and destination. They must also contain any quality of service (QOS) information associated with that message. Each respective router uses the global address and QOS information to perform relaying and routing operations across the various networks comprising the internet.

1.5 Mode S Air/Ground Network Functions

The Mode S Air/Ground Network illustrated in Figure 1-1 and Figure 1-2 incorporates both ground-based and aircraft-based functions. The responsibilities of these functional modules are characterized generally in the following paragraphs.

Note that these functions may be implemented in either an integrated fashion (e.g., a Mode S ADLP/Transponder), or in a component fashion (e.g., a Mode S ADLP connected to the Mode S Transponder via an interface).

1.5.1 Mode S Ground Interrogator

The Mode S Ground Interrogator provides ground modulator/demodulator (modem) functionality for the Mode S network, in addition to providing the normal surveillance functionality of a Mode S secondary surveillance radar.

1.5.2 Mode S Ground Data Link Processor

The Mode S Ground Data Link Processor (GDLP) functions include the segmenting and/or re-assembly of messages for transfer over the Mode S Data Link, as well as providing Mode S channel management. The Mode S GDLP provides the interface between those elements that are specific to the Mode S Data Link (i.e., the Mode S Interrogator), and those that are common to all data link systems (i.e., the ground ATN router). In general, there will be more than one Mode S Interrogator associated with each Mode S GDLP.

1.5.3 Mode S Airborne Transponder

The Mode S Airborne. Transponder provides the aircraft Mode S modem function, in addition to performing its primary duties in conjunction with the ground surveillance radar.

1.5.4 Mode S Airborne Data Link Processor

The Mode S ADLP performs message processing functions parallel to those of the Mode S GDLP. The Mode S ADLP provides the interface between those elements that are specific to the Mode S Data Link (i.e., the Mode S Transponder), and those that are common to all data link systems (i.e., the aircraft ATN router). One operating Mode S Transponder will be associated with each Mode S ADLP.

1.5.5 Higher-Layer Entities

The Mode S ADLP and GDLP modules provide communication services requested by and directed to Higher-Layer Entities (HLEs). As such, the HLE utilizing Mode S network services is typically either a router or an application processor. The particular style of HLE utilized depends upon the level of internetwork operations required within a given installation.

1.6 ISO 8208 Connection-Oriented Protocol

The ISO connection-oriented network protocol standard is defined in ISO 8208 (Ref. 2). This standard specifies the protocol to be utilized in providing either the Connection-Oriented *NETWORK* Service (CONS) or a supporting Connection-Oriented *SUBNETWORK* service.

1.6.1 ISO 8208 Internal Operations

ISO 8208 specifies the dialogue between two network entities, but does not specify the means of transferring the dialogue between the entities. Individual networks may provide connection-oriented service in any practical way, since ISO 8208 does not define techniques for conducting internal network operations. For this reason, the ISO 8208 protocol is referred to as the "X.25 Packet Layer Protocol."

1.6.2 ISO 8208 Circuit Management Techniques

The ISO 8208 protocol supports three classes of connection services:

a. Switched Virtual Circuit (SVC).

b. Permanent Virtual Circuit (PVC).

c. Fast Select (FS).

All three classes of connection service utilize similar data transfer techniques; the primary difference in these service classes is the method of connection establishment.

Table 1-1 lists the different packet types defined by ISO 8208 to support these three classes of services.

The *switched virtual circuit* is the primary circuit management technique provided within the ISO 8208 protocol. An SVC user requests call connection and disconnection services dynamically, as required for support of the controlling end user. SVC connections are established based on source and destination addresses and QOS parameters supplied at the time of connection request. In SVC operation, network resources are allocated when needed and released when they are no longer required.

The *permanent virtual circuit* utilizes source and destination addresses and QOS parameters recorded permanently in each communication node, so that no call set-up procedure is required during network operations. Connection identifiers are permanently assigned, and the PVC user must have prior knowledge of the circuits of interest. The PVC provides no mechanism for dynamic connection management. In PVC operation, network resources are permanently consumed.

The *Fast Select* circuit is a variant of the SVC that allows user data to be transferred with the connect-request and disconnect-request packets. Once the connection has been established, the FS circuit operates in the same fashion as an SVC.

Note: *The switched virtual circuit service is the only class of service supported by the Mode S packet layer protocol.*

Table 1-1 ISO 8208 Packet Types

Name	Function
CALL REQUEST	Channel connection request by first party
CALL ACCEPTED	Second party affirmation of channel connection
CLEAR REQUEST	Request to terminate a channel
CLEAR CONFIRMATION	Second party agrees to channel termination
DATA	Transfer data
INTERRUPT	Limited data transfer as quickly as possible
INTERRUPT CONFIRMATION	Acknowledges reception of INTERRUPT Packet
RECEIVE READY	Acknowledges reception of packets for flow control purposes and indicates receiver in a state to receive more packets
RECEIVE NOT READY	Acknowledges reception of packets and indicates receiver unavailable for further data transfer
RESET REQUEST	Reset channel (outstanding packets lost)
RESET CONFIRMATION	Confirms reset has occurred
RESTART REQUEST	Clears all channels
RESTART CONFIRMATION	Confirms restart has occurred
DIAGNOSTIC	Supplementary error information not available in other packet types
REJECT	Explicit request to resend specified packets

1.7 Mode S Participation in the Aeronautical Telecommunication Network

The key element of Mode S conformance to the Aeronautical Telecommunication Network Architecture is the provision of an ISO SUBNETWORK interface to the HLE via the Mode S ADLP. To support the interface, the Mode S Subnetwork must meet the following requirements:

a. The Mode S Subnetwork interface to the internet (i.e., router) occurs within the NETWORK layer; thus, control information for the DATA LINK and PHYSICAL layers is not passed from network to network. Hence, the Mode S Subnetwork may utilize non-conforming protocols within these layers while maintaining ISO conformance within the NETWORK layer.

b. The Mode S Subnetwork places no requirements on the form or content of the upper-layer headers, but simply transfers the control information for these layers without modification.

c. The Mode S Subnetwork carries ISO NETWORK protocol control information (PCI) for evaluation by each intervening router (i.e., intermediate-system). The INTERNETWORK protocol requires no explicit protocol control information.

d. The Mode S Subnetwork transparently transfers standard global (i.e., ISO Network Service Access Point, NSAP) addressing information for evaluation by each intervening router. Passage of a message from one network to another requires a destination address that is comprehensible to both networks.

1.8 Mode S Airborne Data Link Processor Architecture

The Mode S Airborne Data Link Processor (ADLP) is the avionics component that manages the bi-directional exchange of ISO NETWORK layer data packets between the Airborne FILE and the Ground FILE, via the Mode S Ground Data Link Processor (GDLP), using the Mode S air/ground network. The Mode S ADLP presents a conventional data communication interface protocol to the Airborne HLE, in order to support network interoperability and shield the Airborne HLE from the media-specific nature of the Mode S Transponder protocol. The ADLP/HLE interface conforms to the ISO 8208 standard, and thus allows Mode S to participate in ISO conformant internetworking.

1.8.1 Mode S ADLP Functional Partitions

The Mode S ADLP consists of the following major functions:

a. Management of the ADLP/HLE Interface.

b. Management of Mode S Subnetwork Operations (ADLP/GDLP Protocol).

c. Management of the ADLP/Transponder (DATA LINK) Interface.

These functional partitions are illustrated in Figure 1-3. The ADLP/HLE interface management role consists essentially of performing ISO 8208 operations in its interactions with the Aircraft FILE. The SUBNETWORK management role includes the mapping of ISO 8208 data formats and supervisory functions into Mode S data formats and supervisory functions, as well as the performance of local connection management functions in a mobile environment. The ADLP/Transponder interface management role consists primarily of the transfer of control information and user data between the Mode S ADLP and the Mode S Transponder, in order to control the data communication functions of the transponder.

1.8.1.1 Mode S ADLP/HLE Interface Management

The Mode S ADLP functions as a SUBNETWORK communication module that presents an ISO 8208 Packet Layer Protocol interface to the airborne HLE system component(s). In ISO terms, the Mode S ADLP operates as a *data circuit terminating equipment (DCE)* device in its interactions with the HLE system component(s).

The relationship of the Mode S ADLP to the HLE system components(s) is illustrated in Figure 1-3. The HLE system component operates as a *data terminal equipment (DTE)* device in its interactions with the Mode S ADLP.

Access to the Mode S specific services (broadcast, ground-initiated Comm-B and Mode S protocol) is provided via a separate ADLP interface.

1.8.1.2 Mode S Subnetwork Management

The Mode S ADLP manages the Mode S Subnetwork in order to provide connection-oriented service between the Airborne HLE entities and the Ground HLE entities, as the aircraft moves along its flight path. To accomplish this goal, the Mode S ADLP must perform the conversion of ISO 8208 packets to Mode S packets (see 1.8.2).

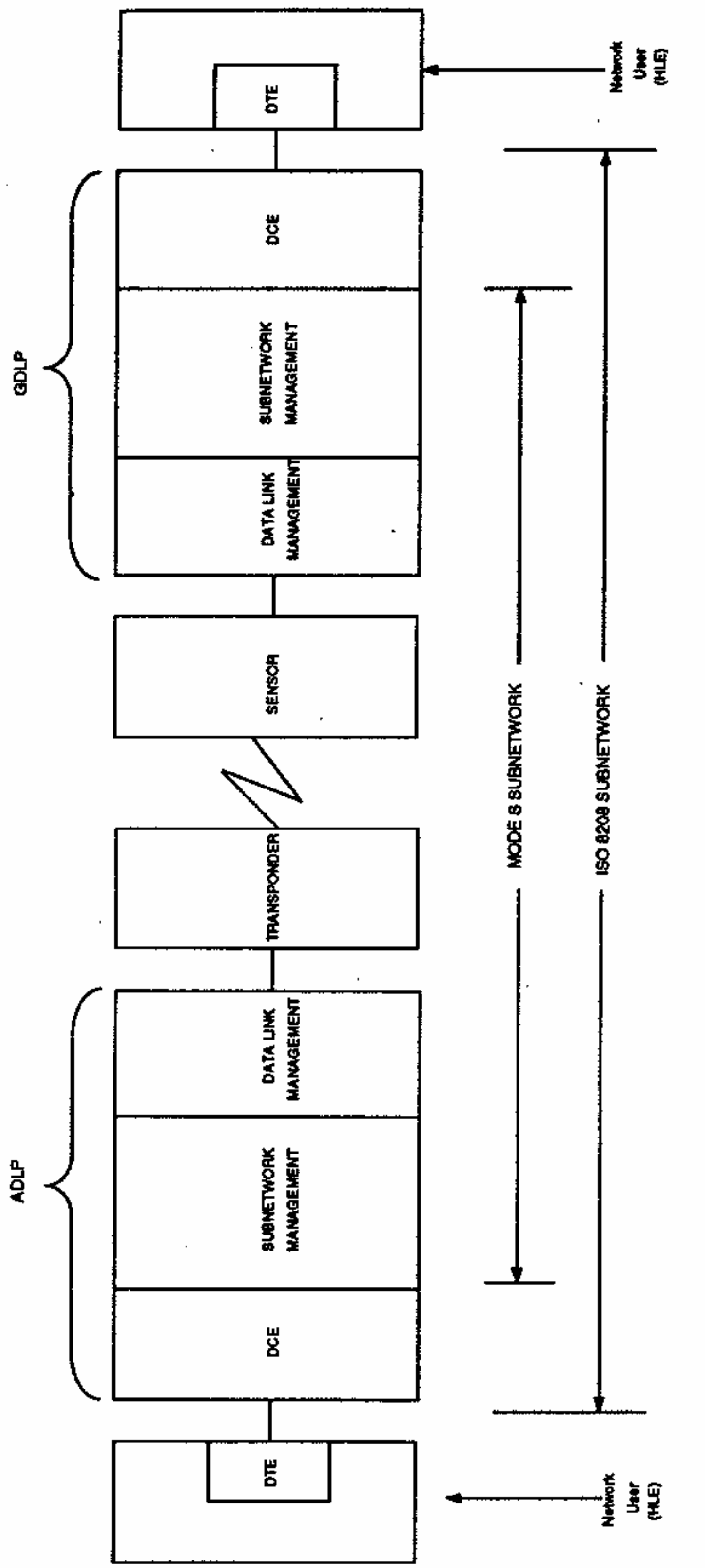

FIGURE 1-3. MODE S AIR/GROUND NETWORK ARCHITECTURE

1.8.1.3 Mode S ADLP/Transponder Interface Management

The Mode S ADLP controls the interface to the Mode S Transponder based on information received from the HLE via the ADLP/HLE interface, and based on the internal processing requirements of the ADLP. Additionally, the Mode S ADLP receives information via the ADLP/Transponder interface, which must be processed and transferred to the HLE.

The Mode S ADLP must also establish and maintain the local connection relationship between the Mode S ADLP and the various Mode S GDLPs with which it communicates.

The Mode S ADLP utilizes air-initiated and multisite-directed transponder protocols to provide ISO 8208 Switched Virtual Circuit capability.

Transponder operation is conducted according to the procedures specified in RTCA/DO-181C (Ref. 3).

1.8.2 Packet Translation and Transfer

The ADLP maps ISO 8208 packets (see Table 1-1) into Mode S packets, based on information provided via the ISO 8208 interface protocol. The ADLP then encapsulates the Mode S packets into Mode S frames, so they may be transferred to the transponder. In a typical downlink data transfer, the following operations would take place:

a. An ISO 8208 data packet is received from the HLE via the ADLP/HLE interface.

b. Using information derived from the ISO 8208 data packet, the Mode S ADLP constructs the appropriate Mode S data packet(s).

c. The Mode S data packet is mapped into the appropriate Mode S frame(s), based on the size of the Mode S data packet(s).

d. The Mode S ADLP selects the appropriate Mode S Data Link protocol (e.g., air-initiated or multisite-directed), and the Mode S frames are passed to the transponder for transmission to the Mode S Ground Interrogator.

There is a one-to-one correspondence between the ISO 8208 packet types and the Mode S packet types; thus, for each packet type of Table 1-1 (with the exception of the diagnostic packet) there exists a corresponding packet type within the Mode S Subnetwork. The Mode S packets differ only in size and in the arrangement of the fields. The relationship between ISO 8208 packets, Mode S packets and Mode S frames is illustrated in Figure 1-4.

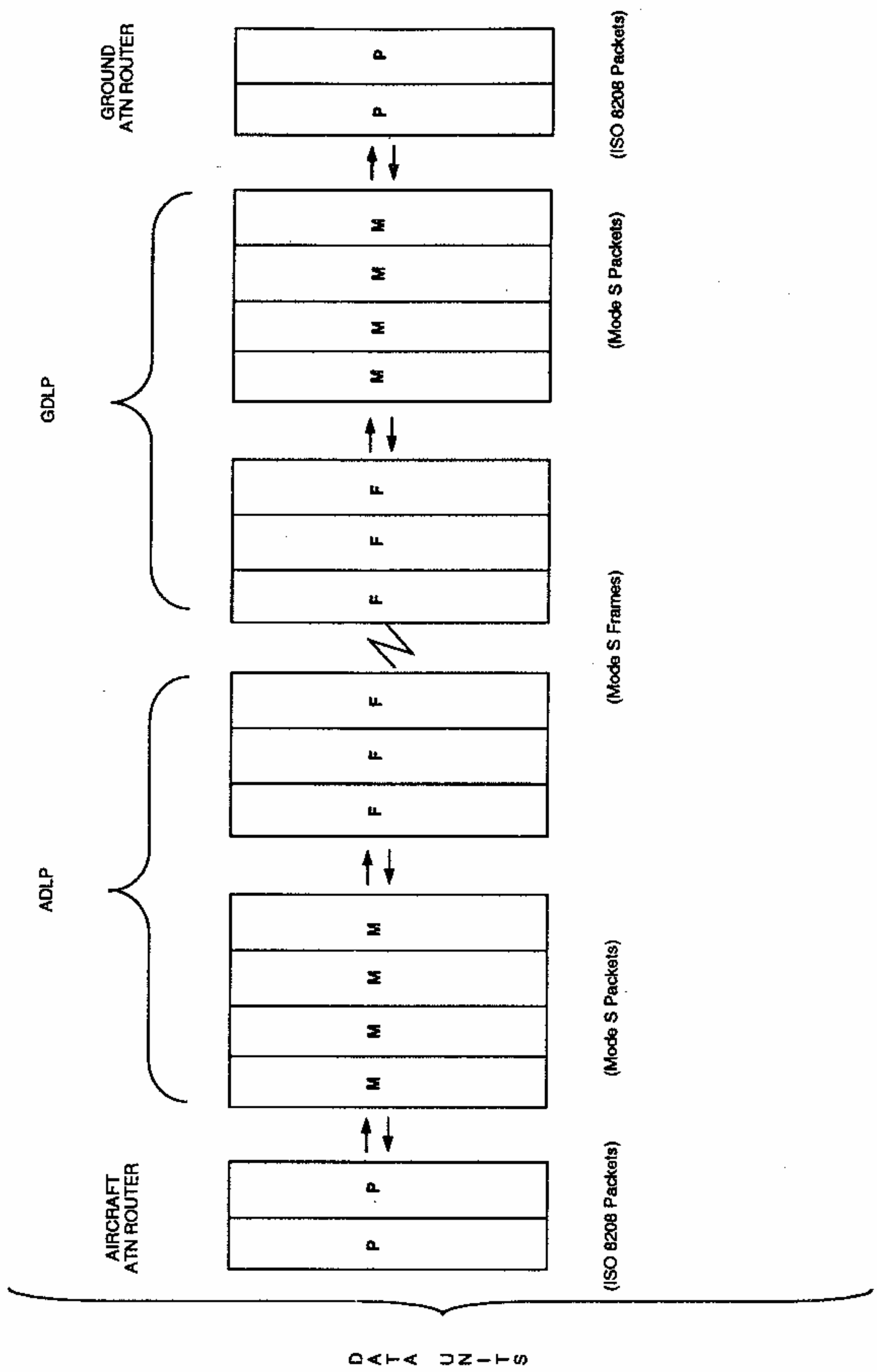

Figure 1-4. CONVERSION OF PACKET FORMATS

1.8.2.1 Mapping ISO 8208 Packets Into Mode S Packets

In order to utilize the Mode S Data Link protocol in an efficient manner, certain ISO 8208 packet fields have been optimized to create Mode S packets for transfer within the Mode S Subnetwork.

1.8.2.2 Mapping Mode S Packets Into Mode S Data Link Frames

Mode S packets are mapped into one or more Comm-A segments, one or more Comm-B segments or extended length messages (ELM), as is appropriate, for transfer via the Mode S Transponder and Mode S Ground Interrogator.

The Mode S Data Link protocol supports the linking of segments in order to transfer Mode S packets that are too large to fit within one segment. A Mode S Data Link frame is defined as one of the following constructs:

a. A single Comm-A or Comm-B segment.

b. A linked sequence of 2 to 4 Comm-A or Comm-B segments.

c. An ELM of 2 to 16 segments.

The size of the Mode S packet will determine the framing strategy to be utilized by the originating DLP.

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2 DESIGN REQUIREMENTS

2.1 General Requirements

2.1.1 Airworthiness

The design and manufacture of the equipment shall provide for an installation that does not impair the airworthiness of the aircraft.

2.1.2 General Purpose

The equipment shall perform its intended function, as defined by the manufacturer, and its proper use shall not create a hazard to users of the National Airspace System.

2.1.3 Federal Communications Commission Rules

The equipment shall comply with all applicable rules of the Federal Communication Commission.

2.1.4 Fire Protection

Except for small parts (such as knobs, fasteners, seals, grommets, and small electrical parts) that would not contribute significantly to the propagation of a fire, all materials used shall be self-extinguishing.

2.1.5 Operation of Controls

The operation of controls intended for use during flight, in all possible combinations and sequences, shall not result in a condition detrimental to the continued performance of the equipment.

2.1.6 Accessibility of Controls

Controls that are not normally adjusted in flight shall not be readily accessible to flight personnel.

2.1.7 Effects of Tests

Unless otherwise provided, the application of the specified tests shall produce no subsequently discernible condition detrimental to the continued performance of the flight.

2.1.8 Data Integrity

The maximum bit error rates for data presented at the ADLP/transponder interface and measured at the local DTE /ADLP interface (and vice versa) shall be 10^{-9} undetected errors and 10^{-7} detected errors. The maximum error rates include all errors resulting from data transfers across the interfaces and from ADLP internal operation.

2.1.9 Timing Requirements for the Mode S ADLP

ADLP operations shall not take longer than 0.25 seconds for regular traffic and 0.125 seconds for interrupt traffic. This interval shall be defined as follows.

a. Transponders with Downlink ELM Capability: The time that the final bit of a 128-byte data packet is presented to the DCE for downlink transfer to the time that the final bit of the first encapsulating frame is available for delivery to the transponder.

b. Transponders with Comm-B Capability: The time that the final bit of a User Data Field of 24 bytes is presented to the DCE for downlink transfer to the time that the final bit of the last of the four Comm-B segments that forms the frame encapsulating the user data is available for delivery to the transponder.

c. Transponders with Uplink ELM Capability: The time that the final bit of the last segment of an ELM of 14 Comm-C segments that contains a User Data Field of 128 bytes is received by the ADLP to the time that the final bit of the corresponding packet is available for delivery to the DTE.

d. Transponders with Comm-A Capability: The time that the final bit of the last segment of four linked Comm-A segments that contains a User Data Field of 25 bytes is received by the ADLP to the time that the final bit of the corresponding packet is available for delivery to the DTE.

The verification of this time interval applies to all the packet transfers described in this document.

2.1.10 Interface Rate

The physical interface between the ADLP and the transponder shall have a minimum bit rate of 100 kilobits per second.

2.1.11 Performance in a Shared Environment

It is recommended that all of the requirements for data integrity and timing requirements take into consideration the effect of other active aircraft data links performing transfer operations in both directions at their nominal rates.

2.1.12 Power Interruption

The ADLP shall be capable of resuming normal operation without loss of data for power interruptions up to 0.5 seconds.

2.1.13 Signals-in-Space

The signals-in-space characteristics of the Mode S data link shall conform to the provisions contained in DO-181C (Ref. 3).

2.1.14 Data Transfer

Data shall be conveyed over the Mode S data link in segments using either Standard Length Message (SLM) protocols or Extended Length Message (ELM) protocols as defined in DO-181C.

<u>*Notes:*</u>

1. An SLM segment is the contents of one 56-bit MA or MB Field. An ELM segment is the contents of one 80-bit MC or MD Field

2. An SLM frame is the contents of up to four MA or MB Fields. An ELM frame is the contents of 2 to 16 MC or 1 to 16 MD Fields.

2.1.15 Bit Numbering

In the description of the data exchange fields, the bits shall be numbered in the order of their transmission, beginning with bit 1. Bit numbers shall continue through the second and higher segments of multi-segment frames. Unless otherwise stated, numerical values encoded by groups (fields) of bits shall be encoded using positive binary notation and the first bit transmitted shall be the most significant bit (MSB).

2.1.16 Unassigned Bits

When the length of the data is not sufficient to occupy all bit positions within a message field or subfield the unassigned bit positions shall be set to ZERO.

2.1.17 Service Provided

The Mode S Subnetwork shall only carry communications classified under the category of safety and regularity of flight.

2.2 Basic Operations

The Mode S subnetwork shall offer the following types of services to the user.

a. Switched Virtual Circuit (SVC) service: The SVC service offered by Mode S is designed to be compatible with other similar services provided by ISO 8208 conformant devices and is designed to support internetworking among various networks.

b. Mode S Protocol service: The Mode S Protocol (MSP) service transfers limited data using extremely low overhead. The MSP service does not use diagnostic, flow control, or interrupt procedures.

c. Broadcast Protocol service: The Mode S subnetwork is capable of supporting information delivery to all interrogators participating in data link operations for that aircraft through the use of the Broadcast Comm-B protocol. It is also able to receive messages directed to all transponders through the use of the Broadcast Comm-A protocol. These services have no counterpart with services provided by an ISO 8208 conformant subnetwork.

d. Ground-Initiated service: The Mode S subnetwork allows a ground user to access data prestored in the transponder. This service has no counterpart with services provided by an ISO 8208 conformant subnetwork.

The SVC services is invoked through an ISO 8208 interface. The MSP, broadcast and ground-initiated services use a separate interface to transfer data into or from the ADLP. These latter services cannot be considered internetwork services in the ISO sense. These services are denoted Mode S specific services and are further defined in 2.2.6. The term "ADLP/GDLP operations" refers to the SVC service, i.e., the service that has a direct counterpart in attached ISO 8208 adherent subnetworks.

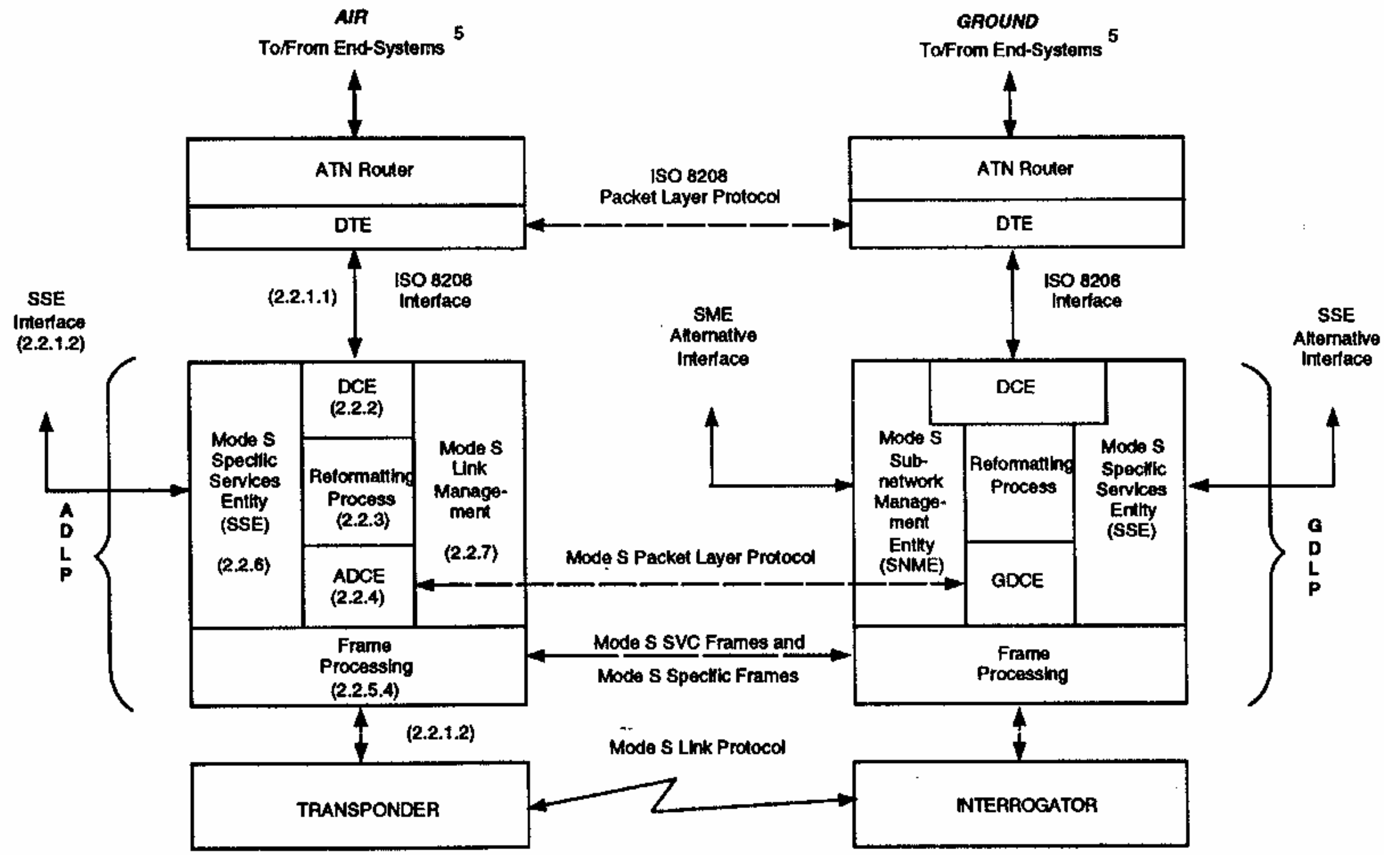
It is the function of the ADLP to:

a. Provide to the user of the Mode S subnetwork a method to access these four services.

b. Provide the necessary internal support procedures for these services.

<u>Note:</u> *<u>Figure 2-1</u> illustrates the essential elements of the Mode S subnetwork and their relationship to the user of the subnetwork. The user accesses the subnetwork via an ISO 8208 interface or the Mode S specific services interface. The ADLP, being that part of the Mode S subnetwork which manages the user interfaces, contains the DCE (2.2.2) and the processing required for Mode S specific services (2.2.6). The ADLP must also communicate with its counterpart, the Ground Data Link Processor (GDLP). This communication is managed by a subprocess within the ADLP denoted the Aircraft DCE (ADCE).*

The protocols relating the transfer of information between the ADLP and the GDLP, or more precisely, between the ADCE and its ground counterpart, the Ground DCE (GDCE), are specified in this document in 2.2.4. Conceptually, the ADLP communications protocol processing has been divided into two subprocesses, the ADCE and the DCE. Logically the data can be viewed as being transferred from the DTE to the DCE, then from the DCE to the ADCE, and then from the ADCE to the GDCE. The unit of information transfer between these elements is termed a packet. Packets formatted according to the specifications of ISO 8208 are transferred over the ISO 8208 interface. Mode S packets are transferred between the ADCE and GDCE. The format of a Mode S packet is specified in this standard (2.2.3 and Appendix B).



Notes:

1. Relevant MOPS paragraph numbers are given in parenthesis.
2. The ADLP/Transponder Interface is also specified in DO 181A.
3. A GDLP may be interfaced to more than one Mode S interrogator.
4. DTEs may be directly associated with end systems.
5. ATN router access to end systems may be made via other intermediate systems.

Key

: physical (RF) connection

: peer level association

: interfaces

FIGURE 2-1. FUNCTIONAL ELEMENTS OF THE MODE S SUBNETWORK

The Reformatting Process in the figure is essentially a reformatter between Mode S packets and ISO 8208 packets. In so doing, this process defines the relationship between the DCE and the ADCE. Section 2.2.3 contains the specifications for the Reformatting Process.

A packet is transferred between the ADLP and GDLP via the Mode S transponder and interrogator. The unit of information transfer between interrogator and transponder is denoted a frame in this specification. The method of frame transfer is not a part of this specification. RTCA/DO-181C (Ref. 3) defines the frame relationship between the interrogator and transponder (Figure 2-1). However, the method by which packets are encapsulated by frames for transfer by the transponder and interrogator is specified in this standard (2.2.5), and is shown in the figure as Frame Processing.

There are no requirements on the method used to physically connect the HLE, ADLP, or transponder. These processes can be physically separated or be viewed as co-processes in the same physical unit. In all cases (one, two, or more units) the interface between the DTE and the ADLP as specified by this document shall be available for testing purposes. The subdivision of the ADLP into DCE, Interface Processing, ADCE, Reformatting Process, Mode S Specific Services, Mode S Subnetwork Management and Frame Processing, is introduced as a conceptual and documentation aid. The existence of the subdivision and availability of the elements is left to the implementor to determine.

2.2.1 Data Exchange Interfaces

2.2.1.1 The DTE ISO 8208 Interface

The interface between the ADLP and the DTE(s) shall conform to ISO 8208 Packet Layer Protocol (PLP). It shall be a requirement of the ADLP to support the procedures of the DTE as specified in ISO 8208. As such, the ADLP shall contain a DCE (2.2.2).

2.2.1.1.1 Requirements for the DTE /DCE Interface

There exist two requirements at the physical and link layer of the DTE/ADLP connection.

a. The interface shall be code and byte independent. There shall be no restrictions on the sequence, order, or pattern of the bits transferred within a packet between the DTE and the ADLP.

b. The interface shall support the transfer of variable length network layer packets.

2.2.1.1.2 DTE Address Requirements

2.2.1.1.2.1 Ground DTE Address

The ground DTE address shall have a total length of 3 Binary Coded Decimal (BCD) digits, as follows:

$X_0X_1X_2$ (X_0 shall be the most significant digit)

Ground DTE addresses shall be decimal numbers in the range of 0 through 255 coded in BCD. Assignment of the DTE addresses shall be a local issue. All DTEs connected to GDLPs having overlapping coverage shall have unique addresses. GDLPs which have a flying time less than T_r (Table 2-8) between their coverage areas shall be regarded as having overlapping coverage.

2.2.1.1.2.2 Mobile DTE Address

The mobile DTE address shall have a total length of 10 BCD digits, as follows:

$X_0X_1X_2X_3X_4X_5X_6X_7X_8X_9$ (X_0 shall be the most significant digit)

The digits X0 to X7 shall contain the octal representation of the 24 bit aircraft address coded in Binary Coded Decimal (BCD). The digits X8X9 shall identify a subaddress for specific DTEs onboard an aircraft. This sub-address shall be a decimal number in the range of 0 through 15 coded in BCD. The following sub-address assignments shall be used:

00 ATN router

01 to 15 Unassigned

2.2.1.1.2.3 Illegal DTE Addresses

DTE addresses outside of the defined ranges or not conforming to the formats for the ground and mobile DTE addresses specified in 2.2.1.1.2.1 and 2.2.1.1.2.2 shall be defined to be illegal DTE addresses. The detection of an illegal DTE address in a CALL REQUEST Packet shall lead to a rejection of the call as specified in 2.2.3.1.5.

2.2.1.1.3 Packet Layer Protocol Requirements of the DTE/DCE Interface

2.2.1.1.3.1 Capabilities

The interface between the DTE and the DCE shall conform to ISO 8208 with the following capabilities:

a. Expedited Data Delivery, (i.e., the use of INTERRUPT Packets with a User Data Field of up to 32 bytes).

b. Priority Facility (with two levels, 2.2.3.2.1.1).

c. Fast Select Facility (2.2.3.2.1.1).

d. Called/calling Address Extension Facility, if required by local conditions (i.e., the XDLP is connected to the DTE via a network protocol that is unable to contain the Mode S address as defined).

Other ISO 8208 facilities and the D-bit and the Q-bit shall not be invoked for transfer over the Mode S packet layer protocol.

2.2.1.1.3.2 Parameter Values

The timer and counter parameters for the DTE/DCE interface shall conform to the default ISO 8208 values.

2.2.1.2 Mode S Specific Services Entity (SSE) Interface Requirements

2.2.1.2.1 General

<u>Note:</u> *Mode S specific services consist of the broadcast Comm-A and Comm-B, Ground-Initiated Comm-B (GICB) and MSP.*

The ADLP shall support the accessing of Mode S specific services through the provision of one or more separate ADLP interfaces for this purpose.

2.2.1.2.2 Functional Capability

Message and control coding via this interface shall support all of the capabilities specified in paragraph 2.2.6.

2.2.1.3 ADLP/Transponder Interface

2.2.1.3.1 Transponder to ADLP

The ADLP shall accept an indication of protocol type from the transponder in connection with data transferred from the transponder to the ADLP. This shall include the following types of protocols:

a. Surveillance interrogation,
b. Comm-A interrogation,
c. Comm-A broadcast interrogation,
d. Uplink ELM.

The ADLP shall also accept the II code of the interrogator used to transmit the surveillance, Comm-A or uplink ELM.

<u>Note:</u> *Transponders will not output all-call and Traffic Alert and Collision Avoidance System (TCAS) information on this interface.*

The ADLP shall accept control information from the transponder indicating the status of downlink transfers. This shall include:

a. Comm-B closeout,
b. Comm-B broadcast time-out,
c. Downlink ELM closeout.

The ADLP shall have access to current information defining the communication capability of the Mode S transponder with which it is operating. This information shall be used to generate the Data Link Capability Report (2.2.8).

2.2.1.3.2 ADLP to Transponder

The ADLP shall provide an indication of protocol type to the transponder in connection with data transferred from the ADLP to the transponder. This shall include the following types of protocols:

a. Ground-initiated Comm-B,
b. Air-initiated Comm-B,
c. Multisite-directed Comm-B,
d. Comm-B broadcast,
e. Downlink ELM,
f. Multisite-directed downlink ELM.

The ADLP shall also provide (1) the II code for transfer of a multisite-directed Comm-B or multisite-directed downlink ELM and (2) the Comm-B Data Selector (BDS) code for a ground-initiated Comm-B.

The ADLP shall be able to perform frame cancellation as specified in 2.2.5.3.5.

2.2.2 The DCE Operation

Note: *The DCE process within the ADLP acts as a peer process to the DTE. The DCE shall support the operations of the DTE with the facilities specified in 2.2.1.1.3. The following requirements do not specify format definitions and flow control on the ISO 8208 interface. The specifications and definitions in ISO 8208 (Ref. 21) shall apply for these cases.*

2.2.2.1 State Transitions

The DCE shall operate as a state machine. Upon entering a state, the DCE shall perform the actions specified in Table 2-1. State transition and additional action(s) shall be as specified in Table A-1 through Table A-10 of Appendix A.

Note: *The next state transition (if any) that occurs when the DCE receives a packet from the DTE is specified by Table A-1 through Table A-6. These tables are organized according to the hierarchy illustrated in Figure 2-2. The same transitions are defined in Table A-7 through Table A-10 when the DCE receives a packet from the ADCE (via the Reformatting Process).*

2.2.2.2 Disposition of Packets

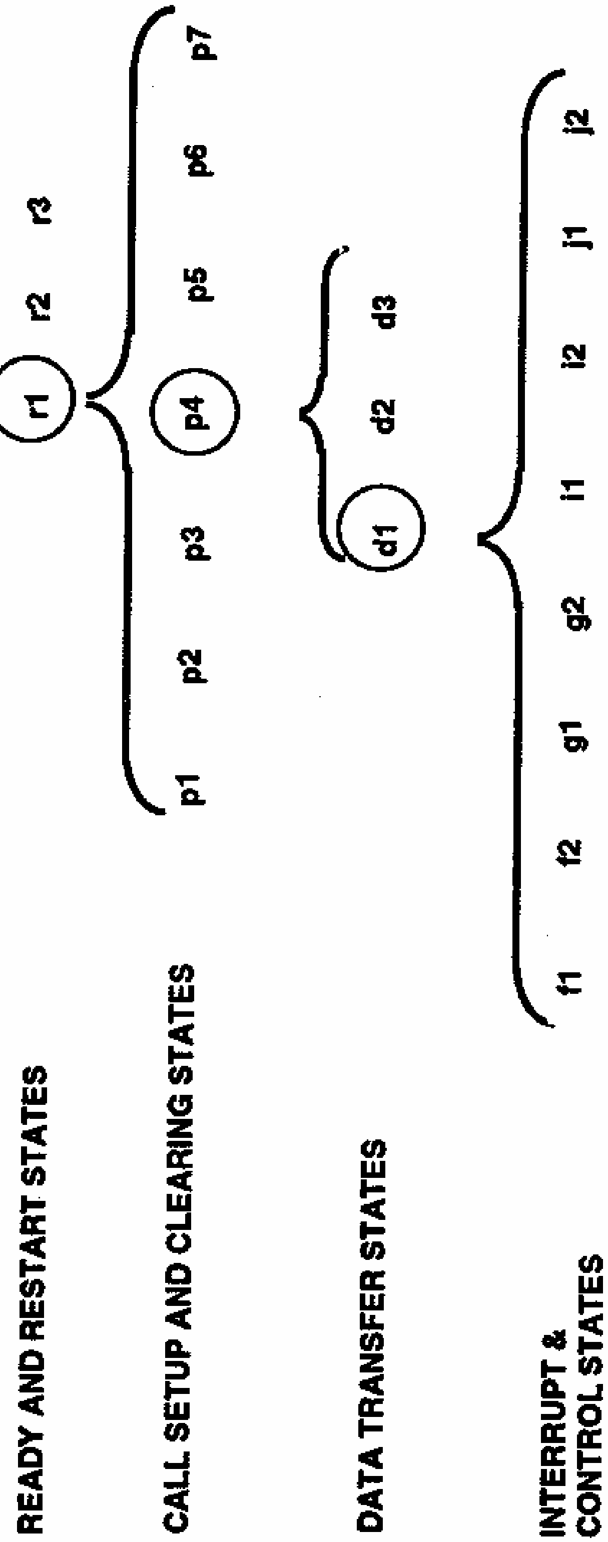
Upon receipt of a packet from the DTE, the packet shall be forwarded or not forwarded to the Reformatting Process according to the parenthetical instructions contained in Tables A-1 to A-6 of Appendix A. If no parenthetical instruction is listed or if the parenthetical instruction indicates "do not forward," the packet shall be discarded.

Upon receipt of a packet from the ADCE, the packet shall be forwarded or not forwarded to the DTE according to the parenthetical instructions contained in Tables A-7 to A-10 of Appendix A. If no parenthetical instruction is listed or if the parenthetical instruction indicates "do not forward," the packet shall be discarded.

<u>Table 2-1</u> DCE Actions at State Transition

DCE State	State Defininition	Action That Shall Be Taken When Entering the State
r1	PACKET LAYER READY	Return all SVCs to the p 1 State (see p 1 State explanation).
r2	DTE RESTART REQUEST	Return each SVC to the p 1 State (see p 1 State explanation) and issue a RESTART CONFIRMATION to the DIE.
r3	DCE RESTART REQUEST	Issue a RESTART REQUEST to the DTE. Unless entered via the r2 State, send a RESTART REQUEST to the Reformatting Process.
p1	READY	Release all resources assigned to SVC. Break the correspondence between the DTE/DCE SVC and the ADCE/GDCE SVC. (The ADCE/GDCE SVC may not yet be in the p1 State.)
p2	DTE CALL REQUEST	Determine if sufficient resources exist to support requests; if so, allocate resources and forward ISO 8208 CALL REQUEST Packet to Reformatting Process; if not, enter DCE CLEAR REQUEST to DTE State (p7). Determination of resources and allocation is as defined in ISO 8208.
p3	DTE CALL REQUEST	Determine if sufficient resources exist to support requests; if so, allocate resources and forward ISO 8208 CALL REQUEST Packet to Reformatting Process; if not, enter DCE CLEAR REQUEST Packet to the ADCE. Determination of resources and allocation is as defined in ISO 8208.
p4	DATA TRANSFER	No Action.
p5	CALL COLLISSION	Reassign outgoing call to another SVC (the DTE in its Call Collision State ignores the incoming call) and enter the DCE Call Request State (p3) for that new SVC. Enter the p2 state to process the CALL REQUEST from the DTE.
p6	DTE CLEAR REQUEST	Release all resources assigned to SVC, send an ISO 8208 CLEAR CONFIRMATION Packet to the DIE and enter p1 State.
p7	DCE CLEAR REQUEST to DTE	Forward CLEAR REQUEST Packet to DTE.
d1	FLOW CONTROL READY	No Action.
d2	DTE RESET REQUEST	Remove DATA Packets transmitted to DTE from window; discard any DATA Packets that represent partially transmitted M-bit sequences and discard any INTERRUPT Packet awaiting transfer to the DTE; reset all window counters to zero; any timers and retransmission parameters relating to DATA and INTERRUPT transfer are set to their initial value.
d3	DCE RESET REQUESTION to DTE	Remove DATA Packets transmitted to DTE from window; discard any DATA Packets that represent partially transmitted M-bit sequences and discard any INTERRUPT Packet awaiting transfer to the DTE; reset all window counters to zero; any timers and retransmission parameters relating to DATA and INTERRUPT transfer are set to their initial value. Forward RESET REQUEST Packet to DTE.
i1	DTE INTERRUPT READY	No Action.
i2	DTE INTERRUPT SENT	Forward INTERRUPT Packet received from DTE to Reformatting Process.
j1	DCE INTERRUPT READY	No Action.

DCE State	State Defininition	Action That Shall Be Taken When Entering the State
j2	DCE INTERRUPT SENT	Forward INTERRUPT Packet received from ADCE to Reformatting Process.
f1	DCE RECEIVE READY	No Action.
f2	DCE RECEIVE NOT READY	No Action.
g1	DTE RECEIVE READY	No Action.
g2	DTE RECEIVE NOT READY	No Action.



Note: States r1, p4, and d1 (shown circled) are states that provide access to the lower levels of the DCE state hierarchy.

FIGURE 2-2. DCE SUBSTATE HIERARCHY

2.2.3 Mode S Packet Layer Processing

2.2.3.1 General Requirements

2.2.3.1.1 Buffer Requirements

Note: Depending on the installation, buffers to operate an SVC may be assigned separately for each process (DCE, ADCE and reformatting) or may exist in a common area.

The following requirements apply to the entire ADLP and shall be interpreted as necessary for each of the main processes (DCE, reformatting, ADCE, Frame Processing and Mode S Specific Services Entity).

The ADLP shall be capable of the following operations.

a. Maintain sufficient buffer space for 15 SVCs.

(1) Maintain sufficient buffer space to hold 15 Mode S subnetwork packets of 152 bytes each in the uplink direction per SVC for a transponder with uplink ELM capability or 28 bytes otherwise.

(2) Maintain sufficient buffer space to hold 15 Mode S subnetwork packets of 160 bytes each in the downlink direction per SVC for a transponder with downlink ELM capability or 28 bytes otherwise.

(3) Maintain sufficient buffer space for two Mode S subnetwork INTERRUPT Packets of 35 bytes each, (User Data Field plus control information), one in each direction, for each SVC.

(4) Maintain sufficient resequencing buffer space for storing 31 Mode S subnetwork packets of 152 bytes each in the uplink direction per SVC for a transponder with uplink ELM capability or 28 bytes otherwise.

(5) Maintain sufficient buffer space for the temporary storage of at least one Mode S packet of 160 bytes per SVC undergoing M-bit or S-bit processing in each direction.

b. Maintain a buffer of 1600 bytes in each direction to be shared among all MSPs.

2.2.3.1.2 The Channel Number Pools

The ADLP shall maintain several SVC channel number pools; the DTE/DCE (ISO 8208) interface uses one set. Its organization, structure and use shall be as defined in the ISO 8208 standard. The other channel pools shall be used on the ADCE/GDCE interface.

The GDLP shall manage a pool of temporary channel numbers in the range of 1 to 3, for each ground DTE/ADLP pair. Mode S CALL REQUEST Packets generated by the GDLP shall contain the ground DTE address and a temporary channel number allocated from the pool of that ground DTE. GDLP shall not reuse a temporary channel number allocated to an SVC that is still in the Call Request state. The ADLP shall use the ground

DTE address to distinguish the temporary channel numbers used by the various ground DTEs.

<u>Note 1:</u> *The use of temporary channel numbers allows the GDLP to have up to 3 CALL REQUESTs in process at the same time for a particular ground DTE and ADLP combination. It also allows the GDLP or ADLP to clear an SVC before the permanent channel number is assigned.*

<u>Note 2:</u> *The ADLP may be in contact with multiple ground DTEs at any one time. All the ground DTEs use temporary channel numbers ranging from 1 to 3.*

The ADLP shall assign a permanent channel number (in the range of 1 to 15) to all SVCS and shall inform the GDLP of the assigned number by including it in the Mode S CALL REQUEST by ADLP or Mode S CALL ACCEPT by ADLP Packets. The temporary channel number shall be included in the Mode S CALL ACCEPT by ADLP together with the permanent channel number in order to define the association of these channel numbers. The ADLP shall continue to associate the temporary channel number with the permanent channel number of an SVC until the SVC is returned to the Ready (p1) State, or else, while in the Data Transfer (p4) State, a Mode S CALL REQUEST by GDLP Packet is received bearing the same temporary channel number. A non-zero permanent channel number in the Mode S CLEAR REQUEST by ADLP, CLEAR REQUEST by GDLP, CLEAR CONFIRMATION by ADLP or CLEAR CONFIRMATION by GDLP packet shall indicate that the permanent channel number shall be used and the temporary channel number shall be ignored. In the event that an XDLP is required to send one of these packets in the absence of a permanent channel number, the permanent channel number shall be set to zero, which shall indicate to the peer XDLP that the temporary channel number is to be used.

<u>Note 3:</u> *The use of a zero permanent channel number allows the ADLP to clear an SVC when no permanent channel number is available, and allows the GDLP to do likewise before it has been informed of the permanent channel number.*

The channel number used by the DTE/DCE interface and that used by the ADCE/GDCE interface shall be assigned independently. The Reformatting Process shall maintain an association table between the DTE/DCE and the ADCE/GDCE channel numbers.

2.2.3.1.3 Receive Ready and Receive Not Ready Conditions

The ISO 8208 interface and the ADCE/GDCE interface management procedures shall be independent operations since each system must be able to respond to separate Receive Ready (RR) and Receive Not Ready (RNR) indications.

2.2.3.1.4 Processing of M-Bit and S-Bit Sequences

<u>Note:</u> *M-bit processing applies to the sequencing of the DATA Packet. S-bit processing applies to the sequencing of Mode S CALL REQUEST, CALL ACCEPT CLEAR REQUEST and INTERRUPT Packets.*

2.2.3.1.4.1 M-Bit Processing

Note 1: The packet size used on the ISO 8208 interface can be different from that used on the ADCE/GDCE interface.

M-bit processing shall be used when DATA Packets are reformatted (2.2.3.2). M-bit processing shall utilize the specifications contained in the ISO 8208 standard. The M-bit sequence processing shall apply on a per SVC basis. The M-bit set to ONE shall indicate that a User Data Field continues in the subsequent DATA Packet. Subsequent packets in an m-bit sequence shall use the same header format (i.e., the packet format excluding the user data field).

If the packet size for the ADCE interface is larger than that used on the ISO 8208 interface, packets shall be combined to the extent possible as dictated by the M-bit, when transmitting a Mode S DATA Packet. If the packet size is smaller on the ADCE/transponder interface than that defined on the ISO 8208 interface, packets shall be segmented to fit into the smaller Mode S packet using M-bit assembly.

A packet shall be combined with subsequent packets if the packet is filled and more packets exist in the M-bit sequence (M-bit = ONE). A packet smaller than the maximum packet size defined for this SVC (partial packet) shall only be allowed when the M-bit indicates the end of an M-bit sequence. A received packet smaller than the maximum packet size with M-bit equal to ONEshall cause a reset to be generated as specified in Ref. 2 and the remainder of the sequence should be discarded.

Note 2: Figure 2-3 illustrates the processing.

Note 3: It is possible for the beginning of an M-bit sequence to be transferred from the DCE to the DTE while the remainder of the M-bit sequence is still being transferred from the ADLP to the GDLP. The same consideration also applies in the uplink direction.

Recommendation In order to decrease delivery delay, reformatting should be performed on the partial receipt of an M-bit sequence, rather than delay reformatting until the complete M-bit sequence is received.

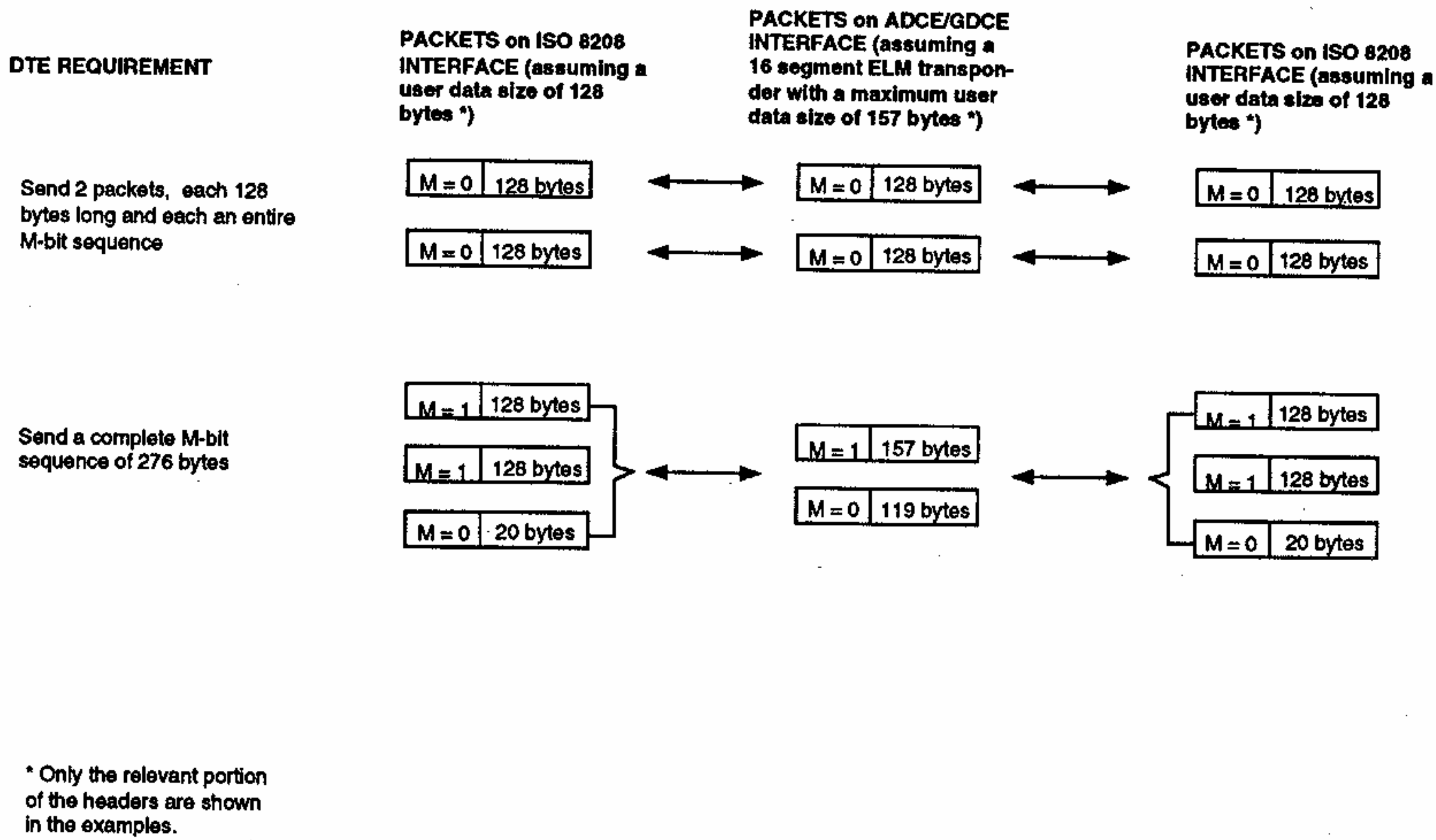


FIGURE 2-3. USE OF M-BIT IN SUBNETWORK PACKETS

2.2.3.1.4.2 S-Bit Processing

S-bit processing shall apply only to Mode S CALL REQUEST, CALL ACCEPT CLEAR REQUEST and INTERRUPT Packets. This processing shall be performed as specified for M-bit processing (2.2.3.1.4.1) except that the packets associated with any S-bit sequence whose reassembly is not completed in Tq seconds (Table 2-8) shall be discarded (2.2.4.3.6, 2.2.4.4.5 and 2.2.4.9), and receipt of a packet shorter than the maximum packet size with S=1 shall cause the entire S-bit sequence to be treated as a format error in accordance with Table A-12.

2.2.3.1.5 Mode S Subnetwork Error Processing for ISO 8208 Packets

D-bit If the XDLP receives a DATA packet with the D-bit set to ONE, the XDLP shall send a RESET REQUEST packet to the originating DTE containing a cause code (CC) = 133 and a diagnostic code (DC) = 166. If the D-bit is set to ONE in a CALL REQUEST packet, the D-bit shall be ignored by the XDLP. The D-bit of the corresponding CALL ACCEPT packet shall always be set to ZERO. The use of CC is optional.

Q-bit If the XDLP receives a DATA Packet with the Q-bit set to ONE, the XDLP shall send a RESET REQUEST packet to the originating DTE containing CC = 133 and DC = 83. The use of CC is optional.

Invalid priority If the XDLP receives a call request with a connection priority value equal to 2 through 254, the XDLP shall clear the virtual circuit using DC = 66 and CC = 131. The use of CC is optional.

Unsupported facility If the XDLP receives a call request with a request for a facility that it cannot support, the XDLP shall clear the virtual circuit using DC = 65 and CC = 131. The use of CC is optional.

Illegal calling DTE address If the XDLP receives a call request with an illegal calling DTE address (2.3.1.3.3), the XDLP shall clear the virtual circuit using DC = 68 and CC = 141. The use of CC is optional.

Illegal called DTE address If the XDLP receives a call request with an illegal called DTE address (2.3.1.3.3), the XDLP shall clear the virtual circuit using DC = 67 and CC = 141. The use of CC is optional.

2.2.3.2 Reformatting Process

Notes:

1. *The Reformatting Process is divided into two subprocesses: uplink and downlink formatting. The uplink process reformats Mode S packets into ISO 8208 packets. The downlink process reformats ISO 8208 packets into Mode S packets. Appendix B defines the Mode S subnetwork packet formats used by the Reformatting Process.*

2. *Mode S packet formats are defined in the following paragraphs. ISO 8208 packet formats are defined in the ISO 8208 standard.*
3. *The complementary GDLP format conversions are included when required for completeness of the description of ADLP processing.*

2.2.3.2.1 CALL REQUEST by ADLP

2.2.3.2.1.1 Translation into Mode S Packets

General Reception by the ADLP Reformatting Process of an ISO 8208 CALL REQUEST Packet from the local DCE shall result in the generation of corresponding Mode S CALL REQUEST by ADLP Packet(s) (as determined by S-bit processing, 2.2.3.1.4.2) as follows:

DP:1	MP:1	SP:2	ST:2	FILL2: 0 or 2	P:1	FILL:1	SN:6	CH:4	AM:4	AG:8

S:1	FS:2	F:1	LV:4	UD:v

The header for second and subsequent packets in an S-bit sequence shall be as specified in Figure B-1.

In formatting the Mode S packet the information shall be derived as follows:

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 1.

Supervisory Type (ST) This field shall be set to 0.

Priority (P) This field shall be set to 0 for a low priority SVC and to 1 for a high priority SVC. The value for this field shall be obtained from the Data Transfer Field of the Priority Facility of the ISO 8208 Packet. This field shall be set to 0 if the ISO 8208 packet does not contain the Priority Facility or if a priority of 225 is specified. The other fields of the Priority Facility shall be ignored.

Sequence Number (SN) For a particular SVC, each packet shall be numbered (2.2.4.9.4).

Channel Number (CH) The channel number shall be chosen from the pool of SVC channel numbers available to the ADLP. The pool shall consist of 15 values from 1 through 15. The highest available channel number shall be chosen from the pool. An available SVC shall be defined as one in state p1. The correspondence between the channel number used by the Mode S subnetwork and the number used by the ISO 8208 interface shall be maintained while the SVC is active.

Note 1: Refer to 2.2.3.1.2 for more information on channel pool management.

Address, Mobile (AM) This address shall be the mobile DTE subaddress (2.2.1.1.2.2) in the range of 0 to 15. The address value shall be extracted from the 2 least significant digits of the calling DTE address contained in the ISO 8208 packet and converted to binary representation.

Note 2: The 24-bit aircraft address is transferred within the Mode S link layer.

Address, Ground (AG) This address shall be the ground DTE address (2.2.1.1.2.1) in the range of 0 to 255. The address shall be extracted from the called DTE address contained in the ISO 8208 packet and converted to binary representation.

Fill Field The fill field shall be used to align subsequent data fields on byte boundaries. When indicated a "FILL:n" the fill field shall be set to "n" bits. When indicated as "FILL1:0 or 6", the fill field shall be set to a length of 6 bits for a non-multiplexed packet in a downlink SLM frame and a lenth of 0 bits for all other cases. When indicated as "FILL2:0 or 2", the fill field shall be set to a length of 0 bits for a non-multiplexed packet in a downlink SLM frame or for a multiplexing header and 2 bits for all other cases.

S Field (S) A value of ONE shall indicate that the packet is part of an S-bit sequence with more packets in the sequence to follow. A value of ZERO shall indicate that the sequence ends with this packet. This field shall be set as specified in 2.2.3.1.4.

FS Field (FS) A value of zero shall indicate that the packet does not contain Fast Select data. A value of two or three shall indicate that the packet contains Fast Select data. A value of two shall indicate normal Fast Select operation. A value of three shall indicate Fast Select with restricted response. An FS value of one shall be undefined.

First Packet Flag (F) This field shall be set to ZERO in the first packet of an S-bit sequence and in a packet that is not part of an S-bit sequence. Otherwise it shall be set to ONE.

User Data Length (LV) This field shall indicate the number of full bytes used in the last SLM or ELM segment as defined in 2.2.5.3.7.

User Data Field (UD) This field shall only be present if optional CALL REQUEST user data (maximum 16 bytes) or Fast Select user data (maximum 128 bytes) is contained in the ISO 8208 packet. The user data field shall be transferred from the ISO 8208 packet unchanged using S-bit processing as specified in 2.2.3.1.4.

2.2.3.2.1.2 Translation into ISO 8208 Packets

General Reception by the GDLP Reformatting Process of a Mode S CALL REQUEST by ADLP Packet (or an S-bit sequence of packets) from the GDCE results in the generation of a corresponding ISO 8208 CALL REQUEST Packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet is the inverse of the processing defined in 2.2.3.2.1.1 with the exceptions as specified in the following paragraph.

Called DTE, Calling DTE Address and Length Fields The calling DTE shall be composed of the 24-bit aircraft address and the value contained in the AM Field of the Mode S packet, converted to BCD (2.2.1.1.2.2). The called DTE shall be the ground DTE address contained in the AG Field of the Mode S packet, converted to BCD. The Length Field shall be as defined in ISO 8208 (Ref. 2).

2.2.3.2.2 CALL REQUEST by GDLP

2.2.3.2.2.1 Translation into Mode S Packets

General Reception by the GDLP Reformatting Process of an ISO 8208 CALL REQUEST Packet from the local DCE results in the generation of corresponding Mode S CALL REQUEST by GDLP Packet(s) (as determined by S-bit processing, 2.2.3.1.4.2) as follows:

DP:1	MP:1	SP:2	ST:2	FILL:2	P:1	FILL:1	SN:6	FILL:2	TC:2	AM:4	AG:8

S:1	FS:2	F:1	LV:4	UD:v

The header for second and subsequent packets in an S-bit sequence shall be as specified in Figure B-2.

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 1.

Supervisory Type (ST) This field shall be set to 0.

Temporary Channel Number Field (TC) This field shall be used to distinguish multiple requests from the GDLP for a channel. The ADLP Reformatting Process, upon receipt of a temporary channel number, shall assign a channel number from those presently in the Ready State, p1 (see Channel Number description in 2.2.3.2.1).

Address, Ground (AG) This address shall be the ground DTE address (2.2.1.1.2.1) in the range of 0 to 255. The address shall be extracted from the calling DTE address contained in the ISO 8208 packet and converted to binary representation.

Address, Mobile (AM) This address shall be the mobile DTE subaddress (2.2.1.1.2.2) in the range of 0 to 15. The address shall be extracted from the 2 least significant digits of the called DTE address contained in the ISO 8208 packet and converted to binary representation.

2.2.3.2.2.2 Translation into ISO 8208 Packets

General Reception by the ADLP Reformatting Process of a Mode S CALL REQUEST by GDLP Packet (or an S-bit sequence of packets) from the ADCE shall result in the generation of a corresponding ISO 8208 CALL REQUEST Packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 2.2.3.2.2.1 with the exceptions as specified in the following paragraph.

Called DTE, Calling DTE Address and Length Fields The called DTE address shall be composed of the 24-bit aircraft address and the value contained in the AM Field of the

Mode S packet, converted to BCD (2.2.1.1.2.2). The calling DTE shall be the ground DTE address contained in the AG Field of the Mode S packet, converted to BCD. The Length Field shall be as defined in ISO 8208 (Ref. 21).

2.2.3.2.3 CALL ACCEPT by ADLP

2.2.3.2.3.1 Translation into Mode S Packets

General Reception by the ADLP Reformatting Process of an ISO 8208 CALL ACCEPT Packet from the local DCE shall result in the generation of corresponding Mode S CALL ACCEPT by ADLP Packet(s) (as determined by S-bit processing, 2.2.3.1.4.2) as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	TC:2	SN:6	CH:4	AM:4	AG:8

S:1	FILL:2	F:1	LV:4	UD:v

The header for second and subsequent packets in an S-bit sequence shall be as specified in Figure B-3.

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 1.

Supervisory Type (ST) This field shall be set to 1.

Temporary Channel Number (TC) The TC value in the originating Mode S CALL REQUEST by GDLP Packet shall be returned to the GDLP along with the channel number (CH) assigned by the ADLP.

Channel Number (CH) The field shall be set equal to the channel number assigned by the ADLP as determined during the CALL REQUEST procedures for the Mode S connection.

Address, Mobile and Address, Ground The AM and AG values in the originating Modes S CALL REQUEST by GDLP Packet shall be returned in these fields. When present, DTE addresses in the ISO 8208 CALL ACCEPT Packet shall be ignored.

2.2.3.2.3.2 Translation into ISO 8208 Packets

General Reception by the GDLP Reformatting Process of a Mode S CALL ACCEPT by ADLP Packet (or an S-bit sequence of packets) from the GDCE results in the generation of a corresponding ISO 8208 CALL ACCEPT Packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet is the inverse of the processing defined in 2.2.3.2.3.1 with the exceptions as specified in the following paragraphs.
Called DTE, Calling DTE Address and Length Fields Where present, the called DTE shall be composed of the 24-bit aircraft address and the value contained in the AM Field of the Mode S packet, converted to BCD (2.2.1.1.2.2). Where present, the calling DTE

shall be the ground DTE address contained in the AG Field of the Mode S packet, converted to BCD. The Length Field shall be as defined in ISO 8208 (Ref. 2).

Note: *The called and calling DTE addresses are optional in the corresponding ISO 8208 packet and are note required for correct operation of the Mode S subnetwork.*

2.2.3.2.4 CALL ACCEPT by GDLP

2.2.3.2.4.1 Translation into Mode S Packets

General Reception by the GDLP Reformatting Process of an ISO 8208 CALL ACCEPT Packet from the local DCE results in the generation of corresponding Mode S CALL ACCEPT by GDLP Packet(s) (as determined by S-bit processing, 2.2.3.1.4.2) as follows:

DP:1	MP:1	SP:2	ST:2	FILL:2	FILL:2	SN:6	CH:4	AM:4	AG:8

S:1	FILL:2	F:1	LV:4	UD:v

The header for second and subsequent packets in an S-bit sequence shall be as specified in Figure B-4.

Fields shown in the packet format and not specified in the following paragraphs are set as specified in 2.2.3.2.1.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 1.

Supervisory Type (ST) This field shall be set to 1.

Address Mobile and Address Ground The AM and AG values in the originating Mode S CALL REQUEST by ADLP Packet shall be returned in these fields. When present, DTE addresses in the ISO 8208 CALL ACCEPT Packet shall be ignored.

2.2.3.2.4.2 Translation into ISO 8208 Packets

General Reception by the ADLP Reformatting Process of a Mode S CALL ACCEPT by GDLP Packet (or an S-bit sequence of packets) from the ADCE shall result in the generation of a corresponding ISO 8208 CALL ACCEPT Packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 2.2.3.2.4.1 with the exceptions as specified in the following paragraph.

Called DTE, Calling DTE Address and Length Fields Where present, the calling DTE shall be composed of the 24-bit aircraft address and the value contained in the AM Field of the Mode S packet, converted to BCD (2.2.1.1.2.2). Where present, the called DTE shall be the ground DTE address contained in the AG Field of the Mode S packet, converted to BCD. The Length Field shall be as defined in ISO 8208 (Ref. 2).

Note: The called and calling DTE addresses are optional in the corresponding ISO 8208 packet and are not required for correct operation of the Mode S subnetwork.

2.2.3.2.5 CLEAR REQUEST by ADLP

2.2.3.2.5.1 Translation into Mode S Packets

General Reception by the ADLP Reformatting Process of an ISO 8208 CLEAR REQUEST Packet from the local DCE shall result in the generation of corresponding Mode S CLEAR REQUEST by ADLP Packet(s) (as determined by S-bit processing, 2.2.3.1.4.2) as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	TC:2	SN:6	CH:4	AM:4	AG:8	CC:8	DC:8

S:1	FILL:2	F:1	LV:4	UD:v

The header for second and subsequent packets in an S-bit sequence shall be as specified in Figure B-5.

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1 and 2.2.3.2.2.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 1.

Channel number (CH) If a channel number has been allocated during the call acceptance phase, then CH shall be set to that value, otherwise it shall be set to zero.

Temporary Channel (TC) If a channel number has been allocated during the call acceptance phase, then TC shall be set to zero, otherwise it shall be set to the value used in the CALL REQUEST by GDLP.

Supervisory Type (ST) This field shall be set to 2.

Address, Ground or Address, Mobile The AG and AM values in the originating Mode S CALL REQUEST by ADLP or CALL REQUEST by GDLP Packets shall be returned in these fields. When present, DTE addresses in the ISO 8208 CLEAR REQUEST Packet shall be ignored.

Clearing Cause (CC) and Diagnostic Code (DC) Fields These fields shall be transferred without modification from the ISO 8208 packet to the Mode, S packet when the DTE has initiated the clear procedure. If the ADLP has initiated the clear procedure, the Clearing Cause Field shall be set to "Out of Order and Diagnostic Field shall be as defined in the state tables for the DCE and ADCE (See also 2.2.4.3.3). The coding and definition of these fields shall be as specified in ISO 8208 (Ref. 2).

2.2.3.2.5.2 Translation into ISO 8208 Packets

General Reception by the GDLP Reformatting Process of a Mode S CLEAR REQUEST by ADLP Packet (or an S-bit sequence of packets) from the local GDCE results in the generation of a corresponding ISO 8208 CLEAR REQUEST Packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet is the inverse of the processing defined in 2.2.3.2.5.1, with the exceptions of the following paragraphs.

Called DTE, Calling DTE and Length Fields These fields shall be omitted in the ISO 8208 CLEAR REQUEST Packet.

Clearing Cause Field This field shall be set taking into account 2.2.4.3.3.

2.2.3.2.6 CLEAR REQUEST by GDLP

2.2.3.2.6.1 Translation into Mode S Packets

General Reception by the GDLP Reformatting Process of an ISO 8208 CLEAR REQUEST Packet from the local DCE results in the generation of corresponding Mode S CLEAR REQUEST by GDLP Packet(s) (as determined by S-bit processing, 2.2.3.1.4.2) as follows:

DP:1	MP:1	SP:2	ST:2	FILL:2	TC:2	SN:6	CH:4	AM:4	AG:8	CC:8	DC:8

S:1	FILL:2	F:1	LV:4	UD:v

The header for second and subsequent packets in an S-bit sequence shall be as specified in Figure B-6.

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.4, 2.2.3.2.2 and 2.2.3.2.5.

Data Packet Type (DP) This field shall be set to 0.

MSP, Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 1.

Channel number (CH) If a channel number has been allocated during the call acceptance phase, then CH shall be set to that value, otherwise it shall be set to zero.

Temporary Channel (TC) If a channel number has been allocated during the call acceptance phase, then TC shall be set to zero, otherwise it shall be set to the value used in the CALL REQUEST by GDLP.

Supervisory Type (ST) This field shall be set to 2.

2.2.3.2.6.2 Translation into ISO 8208 Packets

General Reception by the ADLP Reformatting Process of a Mode S CLEAR REQUEST by GDLP Packet (or an S-bit sequence of packets) from the local ADCE shall result in the generation of a corresponding ISO 8208 CLEAR REQUEST Packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 2.2.3.2.6.1.

Called DTE, Calling DTE and Length Field These fields shall be omitted in the ISO 8208 CLEAR REQUEST Packet.

2.2.3.2.7 DATA

2.2.3.2.7.1 Translation into Mode S Packets

General Reception by the ADLP Reformatting Process of ISO 8208 DATA Packet(s) from the local DCE shall result in the generation of corresponding Mode S DATA Packet(s) as determined by M-bit processing as follows:

DP:1	M:1	SN:6	FELL 1:0 or 6	PS:4	PR:4	CH:4	LV:4	UD: v

Note 1: See 2.2.3.1.4.1 for procedures to be used when the Mode S subnetwork and the ISO 8208 interface use different packet sizes.

Note 2: The values of the PR and PS Fields of the Mode S DATA Packet may not refer to the same packets of the ISO 8208 interface if M-bit reassembly is required.

Data Packet Type (DP) This field shall be set to 1.

M Field (M) A value of ONE shall indicate that the packet is part of an M-bit sequence with more packets in the sequence to follow. A value of ZERO shall indicate that the sequence ends with this packet. The appropriate value shall be placed in the M-bit Field of the Mode S packet.

Note 3: See 2.2.3.1.4 and ISO 8208 (Ref. 2) for a complete explanation.

Sequence Number (SN) The Sequence Number Field shall be set as specified in paragraph 2.2.3.2. 1. 1.

Packet Send Sequence Number (PS) The Packet Send Sequence Number Field shall be set as specified in 2.2.4.4.4.

Packet Receive Sequence Number (PR) The Packet Receive Sequence Number Field shall be set as specified in 2.2.4.4.4.

Channel Number (CH) The Channel Number Field shall contain the Mode S channel number that corresponds to the incoming ISO 8208 DATA Packet channel number.

User Data Length (LV) This field shall indicate the number of full bytes used in the last SLM or ELM segment as defined in 2.2.5.3.7.

Fill (FILL 1) This field shall be set as specified in 2.2.3.2.1.1.

User Data (UD) The user data shall be transferred from the ISO 8208 packet to the Mode S packet utilizing the M-bit packet assembly area as required.

2.2.3.2.7.2 Translation into ISO 8208 Packets

General Reception by the ADLP Reformatting Process of Mode S DATA Packet(s) from the ADCE shall result in the generation of corresponding ISO 8208 DATA Packet(s) to the local DCE. The translation from Mode S packet(s) to the ISO 8208 packet(s) shall be the inverse of the processing defined in 2.2.3.2.6.1.

2.2.3.2.8 INTERRUPT

2.2.3.2.8.1 Translation into Mode S packets

General Reception by the ADLP Reformatting Process of an ISO 8208 INTERRUPT Packet from the local DCE shall result in the generation of corresponding Mode S INTERRUPT Packet(s) (as determined by S-bit processing) as follows:

DP:1	MP:1	SP:2	ST:2	FILL 2:0 or 2	S:1	F:1	SN:6	CH:4	LV:4	UD:v

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 3.

Supervisory Type (ST) This field shall be set to 1.

User Data Length (LV) This field shall be set as specified in 2.2.5.3.7.

User Data (UD) The user data shall be transferred from the ISO 8208 packet to the Mode S packet using the S-bit packet reassembly processing as required. The maximum size of the User Data Field for an INTERRUPT Packet shall be 32 bytes.

2.2.3.2.8.2 Translation into ISO 8208 Packets

General Reception by the ADLP Reformatting Process of Mode S INTERRUPT Packet(s) from the ADCE shall result in the generation of a corresponding ISO 8208 INTERRUPT Packet to the local DCE. The translation from the Mode S packet(s) to the ISO 8208 packet shall be the inverse of the processing defined in 2.2.3.2.8.1.

2.2.3.2.9 INTERRUPT CONFIRMATION

2.2.3.2.9.1 Translation into Mode S Packets

General Reception by the ADLP Reformatting Process of an ISO 8208 INTERRUPT CONFIRMATION Packet from the local DCE shall result in the generation of a corresponding Mode S INTERRUPT CONFIRMATION Packet as follows:

DP:1	MP:1	SP:2	ST:2	SS:2	FILL 2:0 or 2	SN:6	CH:4	FILL:4

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 3.

Supervisory Type (SID) This field shall be set to 3.

Supervisory Subset (SS) This field shall be set to 0.

2.2.3.2.9.2 Translation into ISO 8208 Packets

General Reception by the ADLP Reformatting Process of a Mode S INTERRUPT CONFIRMATION Packet from the ADCE shall result in the generation of a corresponding ISO 8208 INTERRUPT CONFIRMATION Packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 2.2.3.2.9.1.

2.2.3.2.10 RESET REQUEST

2.2.3.2.10.1 Translation into Mode S Packets

General Reception by the ADLP Reformatting Process of an ISO 8208 RESET REQUEST Packet from the local DCE shall result in the generation of a corresponding Mode S RESET REQUEST Packet as follows:

DP:1	MP:1	SP:2	ST:2	FILL 2:0 or 2	FILL:2	SN:6	CH:4	FILL:4	RC:8	DC:8

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 2.

Supervisory Type (SID This field shall be set to 2.

Reset Cause Code (RC) and Diagnostic Code (DC) The Reset Cause and Diagnostic Codes used in the Mode S RESET REQUEST Packet shall be as specified in the ISO 8208 packet when the reset procedure is initiated by the DTE. If the reset procedure originates with the DCE, the DCE state tables specify the Diagnostic Fields coding. In this case bit 8 of the Reset Cause Field shall be set to 0.

2.2.3.2.10.2 Translation into ISO 8208 Packets

General Reception by the ADLP Reformatting Process of a Mode S RESET Packet from the ADCE shall result in the generation of a corresponding ISO 8208 RESET Packet to the local DCE. The translation from the Mode S packet to the ISO 8208 packet shall be the inverse of the processing defined in 2.2.3.2.10.1.

2.2.3.2.11 ISO 8208 RESTART REQUEST to Mode S CLEAR REQUEST

The receipt of an ISO 8208 RESTART REQUEST from the local DCE shall result in the Reformatting Process generating a Mode S CLEAR REQUEST by ADLP or Mode S CLEAR REQUEST by GDLP for all SVCs associated with the requesting DTE. The fields of the Mode S CLEAR REQUEST Packets shall be set as specified in 2.2.3.2.5 and 2.2.3.2.6.

Note: *There are no restart states in the Mode S packet layer protocol.*

2.2.3.3 Packets Local to the Mode S Subnetwork

Note: *Packets defined in this section do not result in the generation of an ISO 8208 packet.*

2.2.3.3.1 Mode S RECEIVE READY

General The Mode S RECEIVE READY Packet is not related to the control of the ISO 8208 interface and shall not cause the generation of an ISO 8208 packet. The format of this packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	FILL 2:0 or 2	FILL:2	SN:6	CH:4	PR:4

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1. This packet shall be processed as specified in 2.2.4.5.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 2.

Supervisory Type (ST) This field shall be set to 0.

Packet Receive Sequence Number (PR) This field shall be set as specified in 2.2.4.4.4.

2.2.3.3.2 Mode S RECEIVE NOT READY

General The Mode S RECEIVE NOT READY Packet arriving from a GDLP is not related to the control of the ISO 8208 interface and shall not cause the generation of an ISO 8208 packet. The format for this packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	FILL 2:0 or 2	FILL:2	SN:6	CH:4	PR:4

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1. This packet shall be processed as specified in 2.2.4.6.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 2.

Supervisory Type (ST) This field shall be set to 1.

Packet Receive Sequence Number (PR) This field shall be set as specified in 2.2.4.4.4.

2.2.3.3.3 Mode S ROUTE

General The format for this packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	OF:1	IN:1	RTL:8	RT:v	ODL:0 or 8	OD:v

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1. This packet shall only be generated by the GDLP. It shall be processed by the ADLP as specified in 2.2.7.1.2 and shall have a maximum size as specified in 2.2.4.2.2.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 3.

Supervisory Type (ST) This field shall be set to 0.

Option Flag (OF) This field shall indicate the presence of the Optional Data Length (ODL) and Optional Data (OD) Fields. OF shall be set to ONE if ODL and OD are present. Otherwise it shall be set to ZERO.

Initialization bit (IN) This field shall indicate the requirement for subnetwork intitalization. It shall be set by the GDLP as specified in 2.2.7.1.2.d.

Note: Initialization causes the clearing of any open SVCs associated with the DTE addresses contained in the ROUTE packet. This is needed to assure that all channels are closed at acquisition and for initialization following recovery after a GDLP failure.

Route Table Length (RTL) This field shall indicate the size of the Route Table, expressed in bytes.

Route Table (RT)

General This table shall consist of a variable number of entries each containing information specifying the addition or deletion of entries in the II code-DTE cross reference table (2.2.7.1).

Table Entries Each entry in the Route Table shall consist of the II code, a list of up to 8 ground DTE addresses, and a flag indicating whether the resulting II code-DTE pairs shall be added or deleted from the II code-DTE cross reference table. A Route Table entry shall be coded as follows:

II:4	AD:1	ND:3	DAL:v

Interrogator Identifier (II) This field shall contain the 4-bit Mode S interrogator II code.

Add/Delete flag (AD) This field shall indicate whether the II code-DTE pairs shall be added (AD = ONE) or deleted (AD = ZERO) from the II code-DTE cross reference table.

Number of DTE addresses (ND) This field shall be expressed in binary in the range from 0 to 7 and shall indicate the number of DTE addresses present in DAL minus 1 (in order to allow from 1 to 8 DTE addresses).

DTE Address List (DAL) This list shall consist of up to 8 DTE addresses, expressed in 8-bit binary representation.

Optional Data Length (ODL) This field shall contain the length in bytes of the following OD Field.

Optional Data Field (OD) This variable length field shall contain optional data of up to 255 bytes as indicated in the ODL Field.

2.2.3.3.4 Mode S CLEAR CONFIRMATION by ADLP

General The format for this packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2	TC:2	SN:6	CH:4	AM:4	AG:8

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1. This packet shall be processed as specified in 2.2.4.3.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 1.

Channel number (CH) If a channel number has been allocated during the call acceptance phase, then CH shall be set to that value, otherwise it shall be set to zero.

Temporary Channel (TC) If a channel number has been allocated during the call acceptance phase, then TC shall be set to zero, otherwise it shall be set to the value used in the CALL REQUEST by GDLP.

Supervisory Type (ST) This field shall be set to 3.

2.2.3.3.5 Mode S CLEAR CONFIRMATION by GDLP

General The format for this packet shall be as follows:

IDP:1	MP:1	SP:2	ST:2	FILL:2	TC:2	SN:6	CH:4	AM:4	AG:8

Fields shown in the packet format and not specified in the following paragraphs are set as specified in 2.2.3.2.1 and 2.2.3.2.5. This packet shall be processed as specified in 2.2.4.3.

Data Packet Type (DP) This field is set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet SP) This field is set to 1.

Channel number (CH) If a channel number has been allocated during the call acceptance phase, then CH shall be set to that value, otherwise it shall be set to zero.

Temporary Channel (TC) If a channel number has been allocated during the call acceptance phase, then TC shall be set to zero, otherwise it shall be set to the value used in the CALL REQUEST by GDLP.

Supervisory Type (ST) This field is set to 3.

2.2.3.3.6 Mode S RESET CONFIRMATION

General The format for this packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	FILL 2:0 or 2	FILL:2	SN:6	CH:4	FILL:4

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.10. This packet shall be processed as specified in Table 2-2.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 2.

Supervisory Type (ST) This field shall be set to 3.

2.2.3.3.7 Mode S REJECT PACKET

General The format for this packet shall be as follows:

DP:1	MP:1	SP:2	ST:2	SS:2	FILL 2:0 or 2	SN:6	CH:4	PR:4

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1. This packet shall be processed as specified in 2.2.4.8. This field shall be set to 3 and indicates that the ST Field follows.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1.

Supervisory Packet (SP) This field shall be set to 3.

Supervisory Type (ST) This field shall be set to 3.

Supervisory Subset (SS) This field shall be set to 1.

Packet Receive Sequence Number (PR) This field shall be set as specified in 2.2.4.4.4.

2.2.3.4 Mode S Packet Summary

Note: A summary of the Mode S packets in bit-oriented form is presented in Appendix B along with a summary of the control fields used in these formats.

2.2.4 ADCE Operation

Note: The ADCE process within the ADLP acts as a peer process to the GDCE process in the GDLP.

2.2.4.1 State Transitions

The ADCE shall operate as a state machine. Upon entering a state, the ADCE shall perform the actions specified in Table 2-2. State transitions and additional action(s) taken shall be as specified in Table A-11 through Table A-18.

Notes:

1. *The next state transition (if any) that occurs when the ADCE receives a packet from the GDCE is specified by Table A-11 through Table A-15. The same transitions are defined in Table A-16 through Table A-18 when the ADCE receives a packet from the DCE (via the Reformatting Process).*

2. *The ADCE state hierarchy is the same as for the DCE as presented in Figure 2-2 except that states r2, r3 and p5 are omitted.*

<u>Table 2-2</u> ADCE Actions at State Transition

ADCE	State Definition	Action That Shall Be Taken When Entering the State
r1	PACKET LAYER READY	Return all SVCs to the p1 State.
p1	READY	Release all resources assigned to SVC. Break the correspondence between the ADCE/GDCE SVC and the DTE/DCE SVC. (The DTE/DCE SVC may not yet be in the p1 State.)
p2	GDLP CALL REQUEST	Determine if sufficient resources exist to support request; if so allocate resources and forward Mode S CALL REQUEST Packet to Reformatting Process; if not, enter ADCE CLEAR REQUEST to GDLP State (p7).
p3	ADCE CALL REQUEST	Determine if sufficient resources exist to support request; if so, allocate resources and forward Mode S CALL REQUEST Packet to Frame Processing; if not, send Mode S CLEAR REQUEST to Reformatting Process and go to state p1. Do not forward the CALL REQUEST to the ADCE.
p4	DATA TRANSFER	No Action.
p6	GDLP CLEAR REQUEST	Release all resources, send a Mode S CLEAR CONFIRMATION Packet to the GDCE and enter the p1 State.
p7	ADCE CLEAR REQUEST to GDLP	Forward Mode D CLEAR REQUEST Packet to the GDCE via Frame Processing.
d1	FLOW CONTROL READY	No Action.
d2	GDLP RESET REQUEST	Remove Mode S DATA Packets transmitted to GDCE from window; discard any DATA Packets that represent partially transmitted M-bit sequences and discard any Mode S INTERRUPT Packet awaiting transfer to the GDCE; reset all flow control window counters to zero (2.2.4.7); any timers and retransmission parameters relating to DATA and INTERRUPT transfer are set to their initial value. Send Mode S RESET CONFIRMATION Packet to the GDCE. Return SVC to d1 State. Forward Mode S RESET REQUEST Packet to Reformatting Process.
d3	ADCE RESET REQUEST to GDLP	Remove Modes S DATA Packets transmitted to GDCE from window;discard any DATA Packets that represent partially transmitted M-bit sequences and discard any Mode S INTERRUPT Packets awaiting transfer to the GDCE; reset all flow control window counters to zero (2.2.4.7); any timers and retransmission parameters relating to DATA and INTERRUPT transfer are set to their initial value. Forward Mode S RESET REQUEST Packet to GDCE via Frame Processing.
il	GDLP INTERRUPT READY	No Action.
i2	GDLP INTERRUPT SENT	Forward Mode S INTERRUPT Packet receive from GDCE to the Reformatting Process.
j1	ADCE INTERRUPT READY	No Action.

Table 2-2 ADCE Actions at State Transition

ADCE	State Definition	Action That Shall Be Taken When Entering the State
j2	ADCE INTERRUPT SENT	Forward Mode S INTERRUPT Packet received from the reformatting process.
f1	ADCE RECEIVE READY	No Action.
f2	ADCE RECEIVE NOT READY	No Action.
g1	GDLP RECEIVE READY	No Action.
g2	GDLP RECEIVE NOT READY	No Action.

2.2.4.2 Disposition of Packets

Upon receipt of a packet from the GDCE, the packet shall be forwarded or not forwarded to the DCE (via the Reformatting Process) according to the parenthetical instructions contained in Table A-11 to Table A-15. If no parenthetical instruction is listed or if the parenthetical instruction indicates " do not forward", the packet shall be discarded.

Upon receipt of a packet from the DCE (via the Reformatting Process), the packet shall be forwarded or not forwarded to the GDCE according to the parenthetical instructions contained in Table A-16 to Table A-18. If no parenthetical instruction is listed or if the parenthetical instruction indicates "do not forward", the packet shall be discarded.

2.2.4.3 SVC Call Setup and Clear Procedure

2.2.4.3.1 Setup Procedures

Upon receipt of a CALL REQUEST from the DCE or GDCE, the ADLP shall determine if sufficient resources exist to operate the SVC. This shall include: sufficient buffer space (refer to 2.2.3.1.1 for buffer requirements) and an available p1 State SVC. Upon acceptance of the CALL REQUEST from the DCE (via the Reformatting Process), the Mode S CALL REQUEST Packet shall be forwarded to Frame Processing. Upon acceptance of a Mode S CALL REQUEST from the GDCE (via Frame Processing), the Mode S CALL REQUEST shall be sent to the Reformatting Process.

Notes:

1. *The ADCE never originates a call. Call requests that are received from an aircraft DTE are relayed to the GDCE. Requests for call setup from the GDCE are relayed to an aircraft DTE.*

2. *It is the responsibility of the DTE to handle the situation when a call accept indication or a call clear indication is not received for an SVC in the Call Request State.*

2.2.4.3.2 Aborting a Call Request

If the DTE and the GDCE abort a call before they have received a CALL ACCEPT Packet, they shall indicate this condition by issuing a CLEAR REQUEST Packet. Procedures for handling these cases shall be as specified in Table A-12 and Table A-16.

2.2.4.3.3 Virtual Call Clearing

If the ADCE receives a Mode S CALL REQUEST from the Reformatting Process that it cannot support, it shall initiate a Mode S CLEAR REQUEST Packet that is sent to the DCE (via the Reformatting Process) for transfer to the DTE (the DCE thus enters the DCE Clear Request to DTE State, p7).

If the ADCE receives a Mode S CALL REQUEST from the GDCE (via the reformatting process) which it cannot support, it shall enter the P7 state. The cause field shall be set as specified in the above.

A means shall be provided to advise the DTE whether a SVC has been cleared due to the action of the peer DTE or due to a problem within the subnetwork itself.

Recommendation The diagnostic cause and cause codes should be set as follows:

a) no channel number available, DC=71, CC=133

b) buffer space not available, DC=71, CC=133, and

c) DTE not operational, DC=162, CC=141

If the ADLP receives a Mode S ROUTE packet with the IN bit set to ONE the ADLP shall perform local initialization by clearing Mode S SVCs associated with the DTE addresses contained in the ROUTE packet. If the GDLP receives a search request (Table 2-7) from an ADLP, the GDLP shall perform local initialization be clearing Modes S SVCs associated with that ADLP. Local initialization shall be accomplished by:

a) releasing all allocated resources associated with these SVCs (including the resequencing buffers);

b) returning these SVCs to the ADCE ready state (p1) and

c) sending Mode S CLEAR REQUEST packets for these SVCs to the DCE (via the reformatting process) for transfer to the DTE.

Note: *This action will allow all ISO 8208 SVCs attached to the Mode S SVCs to be cleared and return to their ready states(p1).*

2.2.4.3.4 Clear Confirmation

When the ADCE receives a Mode S CLEAR CONFIRMATION Packet, the remaining allocated resources to manage the SVC shall be released (including the resequencing buffers) and the SVC shall be returned to the p1 State. Mode S CLEAR CONFIRMATION Packets shall not be transferred to the Reformatting Process.

2.2.4.3.5 Clear Collision

A clear collision occurs at the ADCE when it receives a Mode S CLEAR REQUEST Packet from the DCE (via the Reformatting Process) and then receives a Mode S CLEAR REQUEST Packet from the GDCE (or vice versa). In this event the ADCE does not expect to receive a Mode S CLEAR CONFIRMATION Packet for this SVC and shall consider the clearing complete.

2.2.4.3.6 Packet Processing

The ADCE shall treat an S-bit sequence of Mode S CALL REQUEST, CALL ACCEPT and CLEAR REQUEST Packets as a single entity.

2.2.4.4 Data Transfer and Interrupt Procedures

2.2.4.4.1 General

Data transfer and interrupt procedures shall apply independently to each SVC. The contents of the User Data Field shall be passed transparently to the DCE or to the GDCE. Data shall be transferred in the order dictated by the sequence numbers assigned to the data packets.

To transfer DATA packets, the SVC shall be in a Flow Control Ready State (d1).

2.2.4.4.2 Mode S Packet Size

The maximum size of Mode S packets shall be 152 bytes in the uplink direction and 160 bytes in the downlink direction for installations that have full uplink and downlink ELM capability. The maximum downlink packet size for level four transponders with less than 16 segment downlink ELM capability shall be 10 bytes times the maximum number of downlink ELM segments that the transponder specifies in its Data Link Capability Report. If there is no ELM capability, the maximum Mode S packet size shall be 28 bytes.

Note: *A DTE/DCE interface packet size larger than the Mode S subnetwork installation packet size does not constitute an error. The ADLP will invoke M-bit or S-bit assembly procedures to transfer such packets (2.2.3.1.4).*

The Mode S subnetwork shall allow packets of less than the maximum size to be transferred.

2.2.4.4.3 Flow Control Window Size

The flow control window size of the Mode S subnetwork shall be independent of that used on the DTE/DCE interface. The Mode S subnetwork window size shall be 15 packets in the uplink and downlink directions.

2.2.4.4.4 SVC Flow Control

Flow control shall be managed by means of a sequence number for received packets (PR) and one for packets that have been sent (PS). A sequence number (PS) shall be assigned for each Mode S DATA Packet generated by the ADLP for each SVC. The first Mode S

DATA Packet transferred by the ADCE to Frame Processing when the SVC has just entered the Flow Control Ready State shall be numbered zero. The first Mode S packet received from the GDCE after an SVC has just entered the Flow Control Ready State shall be numbered zero. Subsequent packets shall be numbered consecutively.

A source of Mode S DATA Packets (the ADCE or GDCE) shall not send (without permission from the receiver) more Mode S DATA Packets than would fill the flow control window. The receiver shall give explicit permission to send more packets.

Note 1: *In this way a receiver can always guarantee that it has enough buffers to contain arriving DATA Packets, since the window size will be pre-determined.*

The permission information shall be in the form of the next expected packet sequence number, and shall be denoted PR. If a receiver wishes to update the window and it has data to transmit to the sender, a Mode S DATA Packet shall be used for information transfer. If the window must be updated and no data is to be sent, a Mode S RECEIVE READY (RR) or Mode S RECEIVE NOT READY (RNR) Packet shall be sent. At this point the 'sliding window' shall be moved to begin at the new PR value. The ADCE shall now be authorized to transfer more packets up to the window limit.

Note 2: *The PR Field is contained in the DATA Packet, the RR Packet, the RNR Packet and the REJECT Packet. Any of these packet types can be sent to update the window.*

Note 3: *The sender may have already transmitted packets with sequence numbers (PS) greater than the PR value, if updated PR values were sent in DATA Packets before the ADCE received the full window size complement of packets.*

When the sequence number (PS) of the next Mode S DATA Packet to be sent is in the range PR ≤ PS ≤ PR+ 14 (modulo 16), the sequence number shall be defined to be "in the window" and the ADCE shall be authorized to transmit the packet. Otherwise, the sequence number (PS) of the packet shall be defined to be "outside the window" and the ADCE shall not transmit the packet to the GDCE.

When the sequence number (PS) of the packet received is next in sequence and within the window, the ADCE shall accept this packet. Receipt of a packet with a sequence number (PS):

a. outside the window, or

b. out of sequence, or

c. not equal to zero for the first data packet after entering Flow Control Ready State

shall be considered an error (2.2.4.8).

The receipt of a Mode S DATA Packet with a valid PS number (i.e., the next PS in sequence) shall cause the lower window PR to be changed to that PS value plus 1. The packet receive sequence number (PR) shall be conveyed to the GDLP by a Mode S DATA, RECEIVE READY, RECEIVE NOT READY, or REJECT Packet. A valid PR value shall be transmitted by the ADCE to the GDCE after the receipt of 8 packets provided that sufficient buffer space exists to store 15 packets. Incrementing the PR and PS Fields shall be performed using modulo 16 arithmetic.

<u>Note 4:</u> The loss of a packet which contains the PR value may cause the ADLP/GDLP operations for that SVC to cease.

A copy of a packet shall be retained until the user data has been successfully transferred. Following successful transfer, the PS value shall be updated.

The PR value for user data shall be updated as soon as the required buffer space for the window (as determined by flow control management) is available within the DCE.

Flow control management shall be provided between the DCE and ADCE.

2.2.4.4.5 Interrupt Procedures for Switched Virtual Circuits

If user data is to be sent via the Mode S subnetwork without following the flow control procedures, the interrupt procedures shall be used. The interrupt procedure shall have no effect on the normal data packet and flow control procedures. An interrupt packet shall be delivered to the DTE (or the transponder interface) at or before the point in the stream of data at which the interrupt was generated. The processing of a Mode S INTERRUPT Packet shall occur as soon as it is received by the ADCE.

<u>Note:</u> The use of clear, reset, and restart procedures can cause interrupt data to be lost.

The ADCE shall treat an S-bit sequence of Mode S INTERRUPT Packets as a single entity.

Interrupt packet processing shall have precedence over any other processing for this SVC occurring at the time of the interrupt.

The reception of a Mode S INTERRUPT Packet before the previous interrupt packet has been confirmed (by the receipt of a Mode S INTERRUPT CONFIRMATION Packet) shall be defined as an error. The error results in a reset (see <u>Table A-14</u>).

2.2.4.5 Receive Ready Procedure

<u>Note:</u> The Mode S RECEIVE READY (RR) Packet indicates that the sender of such a packet is ready to receive up to the full window size complement of packets (for this SVC) beginning with the packet number PR.

This type of packet shall be sent if no Mode S DATA Packets (that normally contain the updated PR value) are available for transmittal and it is necessary to transfer the latest PR value. It also shall be sent to terminate a receiver not ready condition.

Receipt of the Mode S RECEIVE READY Packet by the ADCE shall cause the ADCE to update its value of PR for the outgoing SVC. It shall not be taken as a demand for retransmission of packets that have already been transmitted and are still in the window.

Upon receipt of the Mode S RR Packet the ADCE shall go into the ADLP Receive Ready State, g1.

2.2.4.6 Receive Not Ready Procedure

The Mode S RECEIVE NOT READY Packet (RNR) shall be used to indicate a temporary inability to accept additional DATA Packets for the given SVC. The Mode S RNR condition shall be cleared by the receipt of a Mode S RR Packet or a Mode S REJECT Packet.

When the ADCE receives a Mode S RNR Packet from the GDCE it shall update its value of PR for the SVC and stop transmitting Mode S DATA Packets on the SVC to the GDLP. The ADCE shall go into the ADLP Receive Not Ready State, g2.

The ADCE shall transmit a Mode S RNR Packet to the GDCE if it is unable to receive from the GDCE any more Mode S DATA Packets on the indicated SVC. Under these conditions the ADCE shall go into the ADCE Receive Not Ready State, f2.

2.2.4.7 Reset Procedures

When the ADCE receives a Mode S RESET REQUEST Packet from either the GDCE or the DCE (via the Reformatting Process) or (due to an error condition) performs its own reset, the following actions shall be taken.

a. Those Mode S DATA Packets that have been transmitted to the GDCE shall be removed from the window.

b. Those Mode S DATA Packets that are not transmitted to the GDCE but are contained in an M-bit sequence for which some packets have been transmitted shall be deleted from the queue of DATA Packets awaiting transmission.

c. Those Mode S DATA Packets received from the GDCE that are part of an incomplete M-bit sequence shall be discarded.

d. The lower window edge shall be set to zero and the next packet sent shall have a sequence number (PS) of zero.

e. Any outstanding Mode S INTERRUPT Packets to or from the GDCE shall be left unconfirmed.

f. Any Mode S INTERRUPT Packet awaiting transfer shall be discarded.

g. Data packets awaiting transfer shall not be discarded (unless they are part of a partially transferred M-bit sequence).

h. The transition to d1 shall also include a transition to i1, j1, f1 and g1.

The reset procedure shall apply to the Data Transfer State. The error procedure in Table A-12 shall be followed in any other state the reset procedure shall be abandoned.

2.2.4.8 Reject Procedures

When the ADCE receives a Mode S DATA, Packet from the GDCE with incorrect format or whose packet sequence number is not within the defined window (Table A-15) or out of sequence, it shall discard the received packet and send a Mode S REJECT Packet to the GDCE via Frame Processing. The Mode S REJECT Packet shall indicate a value of PR for which retransmission of the Mode S DATA Packets is to begin. The ADCE shall discard subsequent out-of-sequence Mode S DATA Packets whose receipt occurs while the Mode S REJECT Packet response is still outstanding.

When the ADCE receives a REJECT Packet from the GDCE, it shall update its lower window value with the new value of PR and begin to (re)transmit packets with a sequence number of PR.

Reject indications shall not be transferred to the DCE. If the ISO 8208 interface supports the reject procedures, the reject indications occurring on the ISO 8208 interface shall not be transferred between the DCE and the ADCE.

2.2.4.9 Resequencing and Duplicate Suppression

Notes:

1. *If the frames for an SVC include both types (SLM and ELM) the sequence of packets may be lost due to the different delivery times. The order may also be lost if multiple interrogators are used to deliver frames for the same SVC to a given ADLP. The following procedure will correct for a limited amount of desequencing.*

2. *This process serves as an interface between Frame Processing and the ADCE function.*

2.2.4.9.1 General

Resequencing shall be performed independently for the uplink and downlink transfers of each Mode S SVC. The following variables and parameters shall be used:

SNR — A 6-bit variable indicating the sequence number of a received packet on a specific SVC. It is contained in the SN Field of the packet (2.2.3.2.1.1).

NESN — The next expected sequence number following a series of consecutive sequence numbers.

HSNR — The highest value of SNR in the resequencing window.

T_q — Resequencing timers (Table 2-8) associated with a specific SVC.

All operations involving the sequence number shall be performed modulo 64.

2.2.4.9.2 Duplication Window

The range of SNR values between NESN - 32 and NESN - 1 inclusive shall be denoted the duplication window.

2.2.4.9.3 Resequencing Window

The range of SNR values between NESN + 1 and NESN + 31 inclusive shall be denoted the resequencing window. Received packets with a sequence number value in this range shall be stored in the resequencing window in sequence number order.

Note: *The resequencing window is a buffer for the temporary storage of desequenced packets. It is also used to identify duplicate packets.*

2.2.4.9.4 Transmission Functions

For each SVC, the first packet sent to establish a connection (the first Mode S CALL REQUEST or first Mode S CALL ACCEPT Packet) shall cause the value of the SN Field to be initialized to 0. The value of the SN Field shall be incremented after the transmission (or retransmission) of each packet.

The maximum number of unacknowledged sequence numbers shall be 32 consecutive SN numbers. Should this condition be reached then it shall be treated as an error and the channel cleared

Note: *A limit on the number of unacknowledged packets is required since the SN Field is six bits long and therefore has a maximum of 64 different values before the values repeat.*

2.2.4.9.5 Receive Functions

2.2.4.9.5.1 General

The resequencing algorithm shall maintain the variables HSNR and NESN for each SVC. NESN shall be initialized to 0 for all SVCs and shall be reset to 0 when the SVC reenters the channel number pool (2.2.3.1.2).

2.2.4.9.5.2 Processing of Packets within the Duplication Window

If a packet is received with a sequence number value within the duplication window, the packet shall be discarded.

2.2.4.9.5.3 Processing of Packets within the Resequencing Window

If a packet is received with a sequence number within the resequencing window, it shall be discarded as a duplicate if a packet with the same sequence number has already been received and stored in the resequencing window. Otherwise, the packet shall be stored in the resequencing window. Then, if no T_q timers are running, HSNR shall be set to the value of SNR for this packet and a T_q timer shall be started with its initial value (Table 2-8). If at least one Tq timer is running, and SNR is not in the window between NESN and HSNR+1 inclusive, a new Tq timer shall be started and the value of HSNR shall be updated. If at least one T_q timer is running, and SNR for this packet is equal to HSNR +1, the value of HSNR shall be updated.

2.2.4.9.5.4 Release of Packets to the ADCE

If a packet is received with a sequence number equal to NESN, the following procedure shall be followed:

a. This packet and any packets already stored in the resequencing window up to the next missing sequence number, shall be passed to the ADCE and,

b. NESN shall be set to 1 + the value of the sequence number of the last packet passed to the ADCE.

c. The T_q timer associated with any of the released packets shall be stopped.

2.2.4.9.6 T_q Timer Expiration

If a T_q timer expires, the following procedure shall be followed:

a. NESN shall be incremented until the next missing sequence number after that of the packet associated with the Tq time that has expired is detected.

b. Any stored packets with sequence numbers that are no longer in the resequencing window shall be forwarded to the ADCE except that an incomplete S-bit sequence shall be discarded.

c. The Tq timer associated with any released packets shall be stopped.

2.2.5 Frames

2.2.5.1 Uplink Frames

2.2.5.1.1 SLM Frame

An uplink SLM frame shall be composed of up to 4 selectively addressed Comm-A segments.

Note: *Each Comm-A segment (MA Field) received by the ADLP is accompanied by the first 32 bits of the interrogation that delivered the segment. Within these 32 bits is the 16-bit Special Designator (SD) Field.*

2.2.5.1.1.1 SD Field

When the Designator Identification (DI) Field (bits 14-16) has a code value of 1 or 7, the Special Designator (SD) Field (bits 17-32) of each Comm-A interrogation shall be used to obtain the Interrogator Identifier Subfield (IIS, bits 17-20) and the Linked Comm-A Subfield (LAS, bits 30-32). The action to be taken shall depend on the value of LAS. The contents of LAS and IIS shall be retained and shall be associated with the Comm-A message segment for use in assembling the frame as indicated below. All fields other than the LAS Field shall be as defined in DO-181C (Ref. 3).

SD FIELD

For DI=1

					TMS	
ILS	**MBS**	**MES**	**LOS**	**RSS**	**SPARE**	**LAS**
17 20	**21 22**	**23 25**	**26**	**27 28**	**29**	**30 31**

For DI=7

					TMS	
ILS	**RRS**	**SPARE**	**LOS**	**SPARE**	**SPARE**	**LAS**
17 20	**21 24**	**25**	**26**	**27 28**	**29**	**30 32**

Figure 2-4 The SD Field Structure

2.2.5.1.1.2 LAS Coding

The three-bit LAS subfield shall be coded as specified in Table 2-3.

Table 2-3 LAS Subfield Coding

LAS	MEANING
0	single segment
1	linked, 1st segment
2	linked, 2nd but not final segment
3	linked, 3rd but not final segment
4	linked, 4th and final segment
5	linked, 2nd and final segment
6	linked, 3rd and final segment
7	unassigned

2.2.5.1.1.3 Single Segment SLM Frame

If LAS = 0, the data in the MA Field shall be considered a complete frame and shall be made available for further processing.

2.2.5.1.1.4 Multiple Segment SLM Frame

The ADLP shall accept and assemble linked 56-bit Comm-A segments associated with all 16 possible Interrogator Identifier (II) codes. Correct linking of Comm-A segments shall be achieved by requiring that all Comm-A segments have the same value of IIS. If LAS = 1 through 6 the frame shall consist of two to four Comm-A segments as specified in the following:

Note 1: *The number of linked Comm-A's is limited to four because longer linked Comm-A transmissions would result in inefficient utilization of the Mode S link, as well as slow frame delivery. Longer frames can be transferred more efficiently using the ELM protocol.*

Initial Segment If LAS = 1, the MA Field shall be assembled as the initial segment of an SLM frame. In this case, the initial segment shall be stored until all segments of the frame have been received or the frame is canceled.

Intermediate Segment If LAS = 2 or 3, the MA Field shall be assembled in numerical order as an intermediate segment of the SLM frame. It shall be associated with previous segments containing the same value of IIS.

Final Segment If LAS = 4, 5 or 6, the MA Field shall be assembled as the final segment of the SLM frame. It shall be associated with previous segments containing the same value of IIS.

Note 2: A two-segment linked Comm-A will consist of an initial segment (LAS = 1) and a final segment (LAS = 5).

Frame Completion The frame shall be considered complete and shall be made available for further processing as soon as all segments of the frame have been received.

Frame Cancellation An incomplete SLM frame shall be canceled if one or more of the following conditions apply:

a. A new initial segment (LAS=1) is received with the same value of IIS. In this case, the new initial segment shall be retained as the initial segment of a new SLM frame.

b. The sequence of received LAS codes (after the elimination of duplicates) is not contained in the following list:

1. LAS = 0
2. LAS = 1,5
3. LAS = 1,2,6
4. LAS = 1,6,2
5. LAS = 1,2,3,4
6. LAS = 1,3,2,4
7. LAS = 1,2,4,3
8. LAS = 1,3,4,2
9. LAS = 1,4,2,3
10. LAS = 1,4,3,2

c. Tc (seconds) have elapsed since the last Comm-A segment with the same value of US was received. See Table 2-8.

Segment Cancellation

A received segment for an SLM frame shall be discarded if it is an intermediate or final segment and no initial segment has been received with the same value of IIS.

Segment Duplication

If a received segment duplicates a currently received segment number with the same value of IIS, the new segment shall replace the currently received segment.

Note 3: The action of the Mode S link protocols may result in the duplicate delivery of Comm-A segments.

2.2.5.1.2 ELM Frame

An uplink ELM frame shall consist of from 20 to 160 bytes and shall be transferred from the interrogator to the transponder using the protocol defined in DO-181C (Ref. 3). The first 4 bits of each uplink ELM segment (MC Field) shall contain the Interrogator Identifier (II) code of the Mode S interrogator transmitting the ELM. The ADLP shall check the II code of each segment of a completed uplink ELM. If all of the segments contain the same II code, the II code in each segment shall be deleted and the remaining message bits retained as user data for further processing. If all of the segments do not contain the same II code, the entire uplink ELM shall be discarded.

Note: *An uplink ELM frame consists of 2 to 16 associated Comm-C segments, each of which contains the 4-bit II code. Therefore, the capacity for packet transfer is 19 to 152 bytes per uplink ELM frame.*

2.2.5.2 Downlink Frames

Note: *Data is transferred from an ADLP to a GDLP using downlink frames.*

2.2.5.2.1 SLM Frame

A downlink SLM frame shall be composed of up to 4 Comm-B segments. The MB Field of the first Comm-B segment of the frame shall contain a 2-bit Linked Comm-B Subfield (LBS, bit 1 and 2 of the MB Field). This subfield shall be used to control linking of up to 4 Comm-B segments.

Note: *The LBS uses the first two-bit positions in the first segment of a multi or single segment downlink SLM frame. Hence, 54 bits are available for Mode S packet data in the first segment of a downlink SLM frame. The remaining segments of the downlink SLM frame, if any, have 56 bits available.*

2.2.5.2.1.1 LBS Coding

Linking shall be indicated by the coding of the LBS subfield of the MB Field of the initial Comm-B segment of the SLM frame.

The coding of LBS shall be as specified in Table 2-4.

Table 2-4 LBS Subfield Coding

LBS	MEANING
0	single segment
1	initial segment of a two-segment SLM frame
2	initial segment of a three-segment SLM frame
3	initial segment of a four-segment SLM frame

2.2.5.2.1.2 Linking Protocol

In the Comm-B protocol, the initial segment shall be transmitted using the air-initiated or multisite-directed protocols. The LBS Field of the initial segment shall indicate to the ground the number of additional segments to be transferred (if any). Before the transfer of the initial segment to the transponder, the remaining segments of the SLM frame (if any) shall be transferred to the transponder for transmission to the interrogator using the ground-initiated Comm-B protocol. These segments shall be accompanied by control codes that cause the segments to be inserted in ground-initiated Comm-B registers 2, 3 or 4, associated respectively with the second, third, or fourth segment of the frame.

Closeout of the air-initiated segment that initiated the protocol shall not be performed until all segments have been successfully transferred.

Notes:

1. *The linking procedure including the use of the ground-initiated Comm-B protocol is performed by the ADLP.*

2. *When the Mode S interrogator detects a non-zero LBS code in an air-initiated or multisite directed Comm-B segment, it can proceed immediately with the ground-initiated Comm-B protocol and request the remaining segments of the SLM frame. When it has received all of the segments, it closes out the air-initiated or multisite-directed segment that began the linked Comm-B protocol.*

3. *This linking protocol, as well as the linked Comm-A protocol, is transparent to the transponder.*

2.2.5.2.1.3 Directing SLM Frames

If the SLM frame is to be multisite-directed, the ADLP shall determine the II code of the Mode S interrogator or cluster of interrogators (2.2.7.1.3) that shall receive the SLM frame.

2.2.5.2.2 ELM Frame

Note: A downlink ELM consists of 1 to 16 associated Comm-D segments.

2.2.5.2.2.1 Procedure

Downlink ELM frames shall be used to deliver messages greater than 128 bytes and shall be formed using the protocol defined in DO-181C.

2.2.5.2.2.2 Directing ELM Frames

If the ELM frame is to be multisite-directed, the ADLP shall determine the II code of the Mode S interrogator or cluster of interrogators (2.2.7.1.3) that shall receive the ELM frame.

2.2.5.3 Frame Processing

Frame processing shall be performed on all Mode S packets (except for the MSP packet) as specified in 2.2.5.3.1 to 2.2.5.3.9. Frame processing for Mode S specific services shall be performed as specified in 2.2.6.

2.2.5.3.1 General

Comm-A broadcast and GICB segments (2.2.6) shall be passed unchanged through Frame Processing.

With the possible exception of the last 24 bits (address/parity), ADLP Frame Processing shall accept from the transponder the entire content of both 56-bit and 112-bit received uplink transmissions, excluding all-call and TCAS interrogations. ADLP Frame Processing shall provide to the transponder all data for the downlink transmission (2.2.1.3) that is not provided directly by the transponder.

2.2.5.3.2 Delivery Status

ADLP Frame Processing shall accept an indication from the transponder that a specified downlink frame that was previously transferred to the transponder has been closed out as specified in DO-181C (Ref. 3).

2.2.5.3.3 Interrogator Identifier

ADLP Frame Processing shall accept from the transponder, along with the data in each uplink SLM or ELM, the Interrogator Identifier (II) code of the interrogator that transmitted the frame. ADLP Frame Processing shall transfer to the transponder the II code of the interrogator or cluster of interrogators that shall receive a multisite-directed frame.

2.2.5.3.4 Mode S Protocol Type Identification

ADLP Frame Processing shall indicate to the transponder the protocol to be used to transfer the frame: ground-initiated, air-initiated, broadcast, multisite-directed, or extended length.

2.2.5.3.5 Frame Cancellation

ADLP Frame Processing shall be capable of canceling downlink frames previously transferred to the transponder for transmission but for which a closeout has not been indicated. If more than one frame is stored within the transponder, the cancellation procedure shall be capable of canceling the stored frames selectively.

2.2.5.3.6 Frame Determination

A Mode S packet (including multiplexed packets but excluding MSP packets) intended for downlink and less than or equal to 222 bits shall be sent as an SLM frame. A Mode S packet greater than 222 bits shall be sent as a downlink ELM frame for transponders with ELM capability using M-bit processing as necessary (2.2.3.1.4). When M-bit processing is used, all ELM frames containing M=1 shall contain the maximum number of ELM segments that the transponder is capable of transmitting in response to one requesting interrogation (UF=24). If the transponder does not have ELM capability, packets greater than 222 bits shall be sent using the M-bit or S-bit assembly procedures and multiple SLM Frames.

Note: *The maximum length of a downlink SLM frame is 222 bits. This is equal to 28 bytes (7 bytes for four Comm-B segments) minus the 2-bit Linked Comm-B Subfield (2.2.5.2. 1.1).*

2.2.5.3.7 Packet Length

All packets (including a group of packets multiplexed into a single frame) shall be transferred in a frame consisting of the smallest number of segments needed to accommodate the packet. The User Data Field shall be an integral multiple of bytes in length. A 4-bit length parameter (LV) shall be provided in the Mode S DATA, CALL REQUEST, CALL ACCEPT, CLEAR REQUEST and INTERRUPT Packet headers so that during unpacking no additional bytes are added to the User Data Field. The LV Field shall define the number of full bytes used in the last segment of a frame. During LV calculations, the 4-bit II code in the last segment of an uplink ELM message shall be (1) ignored for uplink ELM frames with an odd number of Comm-C segments and (2) counted for uplink ELM frames with an even number of Comm-C segments. The value contained in the LV Field shall be ignored if the packet is multiplexed.

Note: *A specific length field is used to define the length of each element of a multiplexed packet. Therefore the LV Field value is not used. LV field error handling is described in Table A-12.*

2.2.5.3.8 Multiplexing

When multiplexing multiple Mode S packets into a single SLM or ELM frame, the following procedure shall be used. Multiplexing of packets within the ADLP shall not be applied to packets associated with SVCs of different priorities.

Note: *Multiplexing is not performed on MSP packets.*

2.2.5.3.8.1 Recommendation for Multiplexing

When multiple packets are awaiting transfer to the same GDLP, they should be multiplexed into a single frame in order to optimize throughput, provided that packets associated with SVCs of different priorities are not multiplexed together.

2.2.5.3.8.2 Structure

The structure of the multiplexed packets shall be as follows, where the numbers in a field shall signify the field length, and "v" shall signify that the field is of variable length:

HEADER:8	LENGTH:8	1ST PACKET:v	LENGTH:8	2ND PACKET: v	-----------

Multiplexing Header The header for the multiplexed packets shall be as follows:

DP:1	MP:1	SP:2	ST:2	FILL2:0 or 2

Where,

Data Packet Type (DP) = 0.

MSP Packet Type (MP) = 1.

Supervisory Packet (SP) = 3.

Supervisory Type (ST) = 2.

Note: See Figure B-21 for a definition for the field structure used in the multiplexing header.

Length This field shall contain the length of the following packet in bytes.

Any error detected in a multiplexed DATA packet, such as inconsistency between length as indicated in the LENGTH field and the length of the frame hosting that packet, shall result in the discarding of the packet unless the error can be determined to be limited to the LENGTH field, in which case a REJECT packet with the expected PS calue can be sent.

Recommendation For multiplex packets it is recommended that, if the entire packet cannot be de-multiplexed, then the first constituent packet is treated as a format error, and the remainder is discarded.

2.2.5.3.8.3 Termination

The end of a frame containing a sequence of multiplexed packets shall be determined by one of the following events:

a. A length field of all zeros, or

b. Less than 8 bits left in the frame.

2.2.5.3.9 Mode S Channel Sequence Preservation

2.2.5.3.9.1 Application

In the event that multiple Mode S frames from the same SVC are awaiting transfer to the same GDLP, the following procedure shall be used.

2.2.5.3.9.1.1 Procedure

Notes:

1. SLM and ELM transactions can occur independently.

2. Uplink and downlink transactions can occur independently.

2.2.5.3.9.1.2 SLM Frames

SLM frames awaiting transfer shall be transmitted in the order received.

2.2.5.3.9.1.3 ELM Frames

ELM frames awaiting transfer shall be transmitted in the order received.

2.2.5.4 Priority Management

Downlink frames shall be transferred from the ADLP to the transponder in the following order of priority (highest first):

a. Mode S Specific Services,
b. Search Requests (2.2.7.1),
c. Frames containing only high priority SVC packets,
d. Frames containing only low priority SVC packets.

2.2.6 Mode S Specific Services Processing

Mode S specific services shall be processed by an entity in the ADLP termed the Mode S specific services entity (SSE).

2.2.6.1 Processing

Notes:

1. *There are three Mode S specific services protocol types; broadcast, GICB and MSP.*

2. *Control data consists of information permitting message length, , BDS code used to access the data format for a particular register and aircraft 24-bit address, for example, to be determined.*

2.2.6.1.1 Downlink Processing

Note: This section describes the processing of control and message data received from the Mode S specific services interface (2.2.1.2).

2.2.6.1.1.1 General

The ADLP shall be capable of receiving control and message data from the Mode S specific services interface(s) and sending delivery notices to this interface. The control data shall be processed to determine the protocol type and the length of the message data. When a message or control data provided at this interface are erroneous (i.e. incomplete, invalid or inconsistent) the ADLP shall discard the message and deliver an error report at the interface.

Note: The diagnostic content and the error reporting mechanism are a local issue.

2.2.6.1.1.2 Broadcast Processing

The control and message data shall be used to format the Comm-B broadcast message as specified in 2.2.6.4 and transfer it to the transponder.

2.2.6.1.1.3 Ground-Initiated Comm-B (GICB) Processing

The 8-bit BDS code shall be determined from the control data. The 7-byte register content shall be extracted from the received message data. The register content shall be transferred to the transponder, along with an indication of the specified register number. A request to address one of the air-initiated Comm-B registers or the TCAS Active Resolution Advisories Register shall be discarded. The assignment of registers shall be as specified in Table 2-5.

2.2.6.1.1.4 MSP Processing

The MSP message length, channel number (M/CH, 2.2.6.2.1) and optionally the interrogator II code shall be determined from the control data. The MSP message content shall be extracted from the received message data. If the message length is 26 bytes or less, the SSE shall format an air-initiated Comm-B message (2.2.7.1.3) for transfer to the transponder using the Short Form MSP Packet (2.2.6.2.1). If the message length is 27 to 159 bytes and the transponder has adequate downlink ELM capability, the SSE shall format an ELM message for transfer using the Short Form MSP Packet. If the message length is 27 to 159 bytes and the transponder has a limited downlink ELM capability, the SSE shall format multiple Long Form MSP Packets (2.2.6.2.1) using ELM messages as required utilizing the L-bit and the M/SN Fields for association of the packets. If the message length is 27 to 159 bytes and the transponder does not have downlink ELM capability, the SSE shall format multiple long form MSP packets (5.2.7.3.2) using air initiated Comm-B messages, as required utilising the L-bit and M/SN fields for association of the packets. Different frame types shall never be used in the delivery of an MSP message. Messages longer than 159 bytes shall be discarded. The assignment of downlink MSP channel numbers shall be as specified in Table 2-6.

For an MSP, a request to send a packet shall cause the packet to be multisite-directed to the interrogator II code as specified in control data. If no II code is specified, the packet shall be down linked using the air-initiated protocol. A message delivery notice for this packet shall be provided to the Mode S specific interface when the corresponding closeout(s) have been received from the transponder. If a closeout has not been received from the transponder in Tz seconds, as specified in Table 2-8, the MSP packet shall be discarded. This shall include the cancellation in the transponder of any frames associated with this packet. A delivery failure notice for this message shall be provided to the Mode S specific services interface.

Table 2-5 GICB Register Number Assignments

00_{16}	Not valid
01_{16}	Unassigned
02_{16}	Linked Comm-B, segment 2
03_{16}	Linked Comm-B, segment 3
04_{16}	Linked Comm-B, segment 4
05_{16}	Extended squitter airborne position
06_{16}	Extended squitter surface position
07_{16}	Extended squitter status
08_{16}	Extended squitter indentification and type
09_{16}	Extended squitter airborne velocity
$0A_{16}$	Extended squitter event-driven information
$0B_{16}$	Air/air information 1 (aircraft state)
$0C_{16}$	Air/air information 2 (aircraft state)
$0D_{16}$-$0E_{16}$	Reserved for air/air state information
$0F_{16}$	Reserved for ACAS
10_{16}	Data link capability report
11_{16}-16_{16}	Reserved for extention to data link capability report
17_{16}	Comman usage GICB capability report
18_{16}-$1F_{16}$	Mode S specific services capability
20_{16}	Aircraft identification
21_{16}	Aircraft registration number
22_{16}	Antenna positions
23_{16}	Reserved for antenna position
24_{16}	Reserved for aircraft parameters
25_{16}	Aircraft type
26_{16}-$2F_{16}$	Unassigned
30_{16}	ACAS active resolution advisory
31_{16}-$3F_{16}$	Unassigned
40_{16}	Aircraft intention
41_{16}	Next-way point identification
42_{16}	Next-way point position
43_{16}	Next-way point information
44_{16}	Meteorological routine air report
45_{16}	Meteorological hazard report
46_{16}	Reserved for flight management system Mode 1
47_{16}	Reserved for flight management system Mode 2

Table 2-5 GICB Register Number Assignments

48_{16}	VHF channel report
49_{16}-$4F_{16}$	Unassigned
50_{16}	Track and turn report
51_{16}	Position report coarse
52_{16}	Position report fine
53_{16}	Air-reference state vector
54_{16}	Way-point 1
55_{16}	Way-point 2
56_{16}	Way-point 3
57_{16}-$5E_{16}$	Unassigned
$5F_{16}$	Quasi-static parameter monitoring
60_{16}	Heading and speed report
61_{16}-$F0_{16}$	Unassigned
61_{16}	Extended squitter emergency/priority status
62_{16}	Current trajectory change point
63_{16}	Next trajectory change point
64_{16}	Aircraft operational coordination message
65_{16}	Aircraft operational status
66_{16}-$6F_{16}$	Reserved for extended squitter
70_{16}-75_{16}	Reserved for future downlink parameters
76_{16}-$E0_{16}$	Unassigned
$E1_{16}$-$E2_{16}$	Reserved for Mode S BITE
$E3_{16}$-$F0_{16}$	Unassigned
FI_{16} -$F2_{16}$	Military applications
$F3_{16}$-FF_{16}	Unassigned

Table 2-6 MSP Channel Number Assignments

Uplink Channel Number	Assignment
0	Not valid
1	Reserved (Specific Services Management)
2	Reserved (Traffic Information Service)
3	Reserved (Ground-to-Air Alert)
4	Reserved (Ground Derived Position)
5	TCAS Sensitivity Level Control
6	Reserved (Ground-to-Air Service Request)
7	Reserved (Air-to-Ground Service Response)
8-63	Unassigned

Downlink Channel Number	Assignment
0	Not valid
1	Reserved (Specific Services Management)
2	Unassigned
3	Reserved (Data Flash)
4	Reserved (Position Request)
5	Unassigned
6	Reserved (Ground-to-Air Service Response)
7	Reserved (Air-to-Ground Service Request)
8-63	Unassigned

Table 2-7 Broadcast Identifier Number Assignments

Uplink Broadcast Identifier	Assignment
00_{16}	Not valid
01_{16}	Reserved (Differential GPS Correction)
30_{16}	Not valid
31_{16}	Reserved for ACAS (RA broadcast)
32_{16}	Reserved for ACAS (ACAS broadcast)
Others	Unassigned

Downlink Broadcast Identifier	Assignment
00_{16}	Not valid
02_{16}	Reserved (Traffic Information Service)
10_{16}	Data Link Capability Report
20_{16}	Aircraft Identification
FE_{16}	Update Request
FF_{16}	Search Request
Others	Unassigned

2.2.6.1.2 Uplink Processing

Note: This section describes the processing of Mode S specific services messages received from the transponder.

2.2.6.1.2.1 General

The ADLP shall be capable of receiving Mode S specific services messages from the transponder via Frame Processing. The ADLP shall be capable of delivering the messages and the associated control data at the specific services interface. When the resources allocated at the interface are insufficient to accommodate the output data, the ADLP shall discard the message and deliver an error report at this interface.

2.2.6.1.2.2 Broadcast Processing

If the received message is a broadcast Comm-A, as indicated by control data received over the transponder/ADLP interface, the broadcast ID and user data (2.2.6.4) shall be forwarded to the Mode S specific services interface (2.2.1.2), along with the control data that identifies this as a broadcast message. The assignment of uplink broadcast identifier numbers shall be as specified in Table 2-7.

2.2.6.1.2.3 MSP Processing

If the received message is an MSP, as indicated by the packet format header (2.2.6.2), the User Data Field of the received MSP packet shall be forwarded to the Mode S specific services interface (2.2.1.2) together with the MSP channel number (M/CH), the IIS subfield (2.2.5.1.1.1) together with control data that identifies this as an MSP message. L-bit processing (2.2.6.3) shall be performed as required. The assignment of uplink MSP channel numbers shall be as specified in Table 2-6.

2.2.6.2 MSP Packet Formats

2.2.6.2.1 Short Form MSP Packet

The format for this packet shall be as follows:

DP:1	MP:1	M/CH:6	FILL 1:0 or 6	UD:v

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 0 to indicate that this is a Short Form MSP Packet.

MSP Channel Number (M/CH) The field shall be set to the channel number derived from the SSE control data.

Fill Field. (FILL1: 0 or 6) The Fill length shall be 6 bits for a downlink SLM Frame. Otherwise the Fill length shall be 0.

User Data (UD) The User Data Field shall contain message data received from the Mode S specific services interface (2.2.1.2).

2.2.6.2.2 Long Form MSP Packet

The format for this packet shall be as follows:

DP:1	MP:1	SP:2	L:1	M/SN:3	FILL 2:0 or 2	M/CH:6	UD:v

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in 2.2.3.2.1 and 2.2.6.2.1.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1 to indicate that this is not a Short Form MSP Packet.

Supervisory Packet (SP) This field shall be set to 0.

L Field (L) A value of one shall indicate that the packet is part of an L-bit sequence with more packets in the sequence to follow. A value of zero shall indicate that the sequence ends with this packet.

MSP Sequence Number Field (M/SN) This field shall be used to detect duplication in the delivery of L-bit sequences. The first packet in an L-bit sequence shall be assigned a sequence number of 0. Subsequent packets shall be numbered sequentially. A packet received with the same sequence number as the previously received packet shall be discarded.

2.2.6.3 L-Bit Processing

L-bit processing shall be performed only on the Long Form MSP Packet and shall be performed as specified for M-bit processing (2.2.3.1.4.1) except as specified in the following paragraphs.

Upon receipt of a long form MSP Packet the ADLP shall construct the User Data Field by:

a. Verifying that the packet order is correct using the M/SN Field (2.2.6.2.2).

b. Assuming that the User Data Field in the MSP Packet is the largest number of integral bytes that is contained within the frame.

c. Associating each User Data Field in an MSP Packet received with a previous User Data Field in an MSP Packet that has an L-bit value of ONE.

d. Truncating the assembled User Data Field to 151 bytes if necessary.

Note: *Truncation of the user data field is a condition that cannot be reported*

e. If an error is detected in the processing of an MSP packet, the packet shall be discarded.

In the processing of an L-bit sequence, the ADLP shall discard any MSP packets that have duplicate M/SN values. The ADLP shall discard the entire L-bit sequence if a long form MSP Packet is determined to be missing by use of the M/SN Field.

The packets associated with any L-bit sequence whose reassembly is not completed in Tm seconds (Table 2-8) shall be discarded.

2.2.6.4 Broadcast Format

The first byte of the broadcast MA field shall contain the broadcast identifier as specified in Table 2-7.

2.2.7 Mode S Subnetwork Management

2.2.7.1 Interrogator Link Determination Function

Note: The ADLP interrogator link determination function selects the II code of the Mode S interrogator through which a Mode S subnetwork packet may be routed to the desired destination ground DTE.

2.2.7.1.1 General

The ADLP shall construct and manage a Mode S Interrogator-Data Terminal Equipment (DTE) cross reference table whose entries are Mode S interrogator identifier (II) codes, and ground DTE addresses associated with the ground ATN routers or other ground DTEs.

Notes:

1. Due to the requirement for non-ambiguous addresses, a DTE address also uniquely identifies a GDLP.

2. An ATN router may have more than one Ground DTE address.

2.2.7.1.2 Protocol

The following procedures shall be used:

a. When the GDLP initially detects the presence of an aircraft, or detects contact with a currently acquired aircraft through an interrogator with a new II code, the appropriate fields of the DATA LINK CAPABILITY report shall be examined to determine if, and to what level, the aircraft has the capability to participate in a data exchange. After positive determination of data link capability, the GDLP shall uplink one or more Mode S ROUTE packets as specified in paragraph 5.2.5.3.3. This information shall relate the Mode S II code with the ground DTE addresses accessible through that interrogator. The ADLP shall update the II code-DTE cross reference table and then discard the Mode S ROUTE packet(s);

b. An II code-DTE cross reference table entry shall be deleted when commanded by a Mode S ROUTE Packet or when the ADLP recognizes that the transponder has not been selectively interrogated by a Mode S interrogator with a given II code for 'Ts' seconds by monitoring the US subfield in Mode S surveillance or Comm-A interrogations (Table 2-8).

c. When the GDLP determines that modification is required to the Mode S interrogator assignment, it shall transfer one or more Mode S ROUTE Packet(s) to the ADLP. The update information contained in the Mode S ROUTE Packet shall be used by the ADLP to modify its cross reference table. Additions shall be processed before deletions.

d. When the GDLP sends the initial ROUTE packet after acquisition of a Mode S data link equipped aircraft, the IN bit shall be set to ONE. This value shall cause the ADLP to perform the procedures as specified in 2.2.4.3.3. Otherwise, the IN bit shall be set to ZERO.

e. When the ADLP is initialized (e.g., after a power-up procedure), the ADLP shall issue a search request by sending a broadcast Comm-B message with broadcast identifier equal to 255 (FF_{16}, as specified in Table 2-7) and the remaining 6 bytes unused. On receipt of a search request, a GDLP shall respond with one or more Mode S ROUTE packets, and shall clear all SVCs associated with the ADLP, as specified in 2.2.4.3.3 and discard the search request. This shall cause the ADLP to initialize the II code-DTE cross reference table.

f. On receipt of an update request (Table 2-7), a GDLP shall respond with one or more Mode S ROUTE packets, and discard the update request. This shall cause the ADLP to update the II code-DTE cross reference table.

Note: *The update request may be used by the ADLP under exceptional circumstances (e.g., changeover to standby unit) to verify the contents of its II code-DTE cross reference table.*

2.2.7.1.3 Procedures for Downlinking Mode S Packets

When the ADLP has a packet to downlink, the following procedures shall apply.

a. CALL REQUEST Packet If the packet to be transferred is a CALL REQUEST, the Ground DTE Address Field shall be examined and shall be associated with a connected Mode S interrogator using the Mode S interrogator-DTE cross reference table. The packet shall be downlinked using the multisite-directed protocol. A request to transfer a packet to a DTE address not in the cross reference table shall result in the action specified in 2.2.4.3.3.

b. Other SVC Packets For an SVC, a request to send a packet to a ground DTE shall cause the packet to be multisite-directed to the last Mode S interrogator used to transfer successfully (uplink or downlink) a packet to that DTE, provided that this Mode S interrogator is currently in the Mode S interrogator-DTE cross reference table. Otherwise, an SVC Packet shall be downlinked using the multisite-directed protocol to any other Mode S interrogator associated with the specified ground DTE address.

Level 5 transponders shall be permitted to use additional interrogators for downlink transfer as indicated in the Mode S interrogator-DTE cross reference table.

A downlink frame transfer shall be defined to be successful if its Comm-B or ELM closeout is received from the transponder within Tz seconds as specified in Table 2-8. If the attempt is not successful and an SVC packet is to be sent, the Mode S interrogator-DTE cross reference table shall be examined for another entry with the same called Ground DTE address and a different Mode S interrogator II. The procedure shall be retried using the multisite-directed protocol with the new, Mode S interrogator. If there are no entries for the required called DTE, or all entries result in a failed attempt, a link failure shall be declared (2.2.7.2.1).

2.2.7.2 Error Procedures

2.2.7.2.1 Link Failure

The failure to deliver a packet to the referenced GDLP after an attempt has been made to deliver this packet via all available interrogators shall be declared to be a link level failure. For an SVC, the ADCE shall enter the state p1, and release all resources associated with that SVC. This shall include the cancellation in the transponder of any frames associated with this SVC. A CLEAR REQUEST Packet shall be sent to the DCE via the reformatting process and shall be forwarded by the DCE as an ISO 8208 packet to the local DTE with CC=137 and DC=225. Bit 8 of the cause field shall be set to ONE. On the aircraft side, the SVC shall not be returned to the ADCE channel pool, i.e., does not return to the state p1, until Tr seconds after the link failure has been declared (see Table 2-8).

2.2.7.2.2 Active Channel Determination

2.2.7.2.2.1 Procedure for d1 State

The ADLP shall monitor the activity of all SVCs, not in a Ready State (p1). If an SVC is in the (ADCE) Flow Control Ready State (dl) for more than 'Tx' seconds (the active channel timer, Table 2-8) without sending a Mode S RR, RNR, DATA, or REJECT Packet, then:

a. If the last packet sent was a Mode S REJECT Packet to which a response has not been received, then the ADLP shall resend that packet.

b. Otherwise the ADLP shall send a Mode S RR or RNR Packet as appropriate to the GDLP.

2.2.7.2.2.2 Procedure for Other States

If an ADCE SVC is in the p2, p3, p6, p7, d2 or d3 State for more than ‘Tx’ seconds, the link failure procedure of 2.2.7.2.1 shall be performed.

Link failure shall be declared if either a failure to deliver, or a failure to receive, keep-alive packets has occurred. In which case the channel shall be cleared.

2.2.7.3 Support for the DTE(s)

2.2.7.3.1 ADLP Connectivity Reporting

The ADLP shall notify all aircraft DTEs whenever the last remaining entry for a ground DTE is deleted from the Mode S II code-DTE cross reference table (2.2.7.1). This notification shall include the address of this DTE.

2.2.7.3.2 Communications Requirements

The mechanism for communication of changes in subnetwork connectivity shall be a confirmed service.

2.2.8 The Data Link Capability Report Format

This report shall be transferred using the ground-initiated and broadcast Comm-B protocol, as specified in DO-181C (Ref. 3).

2.2.8.1 Format

The format of the MB Field shall be as follows:

<u>Bit</u>	<u>Content</u>
1-8	BDS Label = 00010000_2
9	Continuation 0=No continuation 1=Continues in next register
10-15	Unassigned
16	Reserved for TCAS
17-23	Mode S Subnetwork Version No. 0 = Mode S subnetwork not available 1 = Version No. 1 2-127 = Unassigned

<u>Note:</u> *Version 1 is defined by this document.*

24	Transponder Level 0 = Level 2-4 1 = Level 5 (Enhanced Protocol)
25	Mode Specific Services Capability 0 = Not Available 1 = Available
26-28	Uplink ELM (UELM) Capability 0 = No UELM Capability 1 = 16 UELM segments in 1 second 2 = 16 UELM segments in 500 ms

3 = 16 UELM segments in 250 ms
4 = 16 UELM segments in 125 ms
5 = 16 UELM segments in 60 ms
6 = 16 UELM segments in 30 ms
7 = Unassigned

29-32	Downlink ELM: Throughput capability of downlink ELM containing the maximum number of ELM segments that the transponder can deliver in response to a single requesting interrogation (UF=24). 0 = No DELM capability 1 = One 4 segment DELM-every second 2 = One 8 segment DELM-every second 3 = One 16 segment DELM every second 4 = One 16 segment DELM every 500 ms 5 = One 16 segment DELM every 250 ms 6 = One 16 segment DELM- every 125 ms 7-15 = Unassigned
33	Aircraft Identification Capability (Table 2-5) 0 = No Aircraft Identification Capability 1 = Aircraft Identification Capability
34-36	34 Squitter capability subfield 35 Surveillance Identifier 36 Common usage GICB report
37 to 40	Reserved for WAS
41 to 56	Bit array indicating the support status of DTE sub-address 0 to 15 Bit value 0=DTE not supported Bit value 1=DTE supported

Note: *The Mode S transponder may update bits 1-8, 16, 33 and 37-40 independent of the ADLP. Bits 1-8 are provided by the transponder when the Data Link Capability Report is broadcast as a result of a transponder detected change in capability reported by the ADLP.*

2.2.8.2 Protocol

In all cases the first bit shall be the high order bit and shall be the first bit transmitted. ADLP Frame Processing shall generate the data link capability report at least once per second and transfer it to the transponder at least once every second.

Note: *The transponder will determine when to relay the report to the ground as specified in DO-181C (Ref. 3).*

2.2.9 System Timers

The values for timers referenced in this specification shall conform to the values given in Table 2-8.

Table 2-8 ADLP Mode S Subnetwork Timers

Timer Name	Timer Label	Nominal Value	Reference
Channel Retirement	Tr	600 Sec	2.2.7.2.1
Active Channel	Tx	420 Sec	2.2.7.2.2.1
Interrogator Interrogation	Ts	60 Sec	2.2.7.1.2
Interrogator Link	Tz	30 Sec	2.2.7.1.3, 2.2.6.1.1.4
Link Frame Cancellation	Tc	60 Sec	2.2.5.1.1.4
L bit Delivery	Tm	120 Sec	2.2.6.3
Packet Resequencing and S-bit Processing	T_q	60 Sec	2.2.4.9.1, 2.2.3.1.4.2

Tolerace for all timers shall be ± 1 percent.
Resolution for all timers shall be 1 second.

2.2.10 Built-In Test

The ADLP shall include a built-in test function that performs a CPU diagnostic and a complete memory diagnostic. This test shall be performed automatically at power-on. If the ADLP fails the test, it shall not initiate operation of the ADLP operational software.

2.3 Equipment Performance – Environmental Conditions

2.3.1 General Requirements

The environmental tests and their associated performance requirements described in this subsection are intended to provide a laboratory means of determining the electrical and mechanical performance of the equipment under environmental conditions expected to be encountered in actual aircraft operations.

Unless otherwise specified, the test procedures applicable to a determination of equipment performance under environmental test conditions are annotated in RTCA/DO-160D (Ref. 4). General information regarding the use of the procedures in RTCA/DO-160D is contained in Sections 1.0 through 3.0 of that document.

Some of the minimum performance requirements in Subsections 2.1 and 2.2 of this MOPS are not required to be qualified to all of the conditions contained in RTCA/DO-160D. Judgment and experience have indicated that these particular performance parameters are not susceptible to certain environmental conditions and that the level of performance specified in Subsections 2.1 and 2.2 will not be measurably degraded by exposure to these conditions.

Certain environmental tests contained in this subsection are identified by the phrase "when required." These tests need not be performed unless the manufacturer wishes to qualify the equipment for that particular environmental condition. If the equipment is to be qualified to a particular environmental condition, then these "when required" tests shall be performed.

2.3.2 ADLP/Transponder Configurations

This MOPS contains provisions to subject two different ADLP configurations to environmental qualification. One ADLP configuration is for the ADLP to perform as a stand-alone process in a separate chassis. For this case, specific data link processor performance tests have been included in Subsection 2.4.3 for use in conjunction with the environmental procedures of RTCA/DO-160D. These tests are a subset of the full data link processor performance tests contained in Subsection 2.4.4 of this MOPS. Normally, a MOPS does not provide specific equipment performance tests to be used in conjunction with the environmental procedures of RTCA/DO-160D. However, there are a sufficiently large number of performance tests in Subsection 2.4.4 that would make a test procedure which included all of the performance tests combined with the appropriate environmental procedure impractical.

The second ADLP configuration is to incorporate the ADLP as an integral process within the transponder. For this case, instructions are provided in each test (Subsection 2.4.4 of this MOPS) to merge the ADLP and transponder test sequences. To facilitate environmental testing, the ADLP (environmental) test sequence was designed to correspond to the transponder (environmental) test sequence enabling the two sequences to be performed concurrently. It is, however, a requirement to perform RTCA/DO-160D tests for groups one and two as a minimum, as defined in Table 2.3.1.1 of RTCA/DO-181C (Ref. 3), when running the test sequence.

When running concurrent transponder and ADLP environmental tests, the environmental test requirements in RTCA/DO-181C (Ref. 3) Table 2.3.1.1 take precedence over Table 2-9 of this MOPS. Where the requirements are different, use RTCA/DO-181C (Ref. 3) as the reference standard. Paragraph 2.4.3.1 contains additional instructions to merge the ADLP test packets with the transponder interrogation sequence, when performing a single environmental sequence on a transponder and integral ADLP.

2.3.3 Configuration Control

Normally, manufacturers perform nominal environment testing, followed by extreme environment testing. It is a requirement of this MOPS that both sequences be conducted on the ADLP with the operational flight program (OFP) installed according to the correct software version number as specified in the ADLP configuration documentation. This condition applies whether the subset environmental procedures or the full environmental qualification sequence is used.

Table 2-9 is a compliance matrix which cross references the RTCA/DO-160D environmental test requirements with the performance requirements (Subsections 2.1 and 2.2) and subset test requirements (Subsection 2.4.3) of this MOPS. It is to be used when planning an environmental qualification using the subset test procedures in paragraphs 2.4.3.1.1 through 2.4.3.1.4.

If the full environmental sequence is performed (transponder with integral ADLP), the rules of Subsection 2.3 in RTCA/DO-181C [Ref. 3]) shall apply. This means that when the transponder and ADLP test sequence are merged the rules and conditions of the transponder test sequences shall apply to the ADLP sequence.

2.3.4 Scientific Environmental Test Conditions

The equipment shall be subjected to the test conditions as specified in RTCA/DO-160D, in the paragraphs identified in Table 2-9 the conformance matrix. By performing (and passing) those tests, the corresponding requirements of this standard shall be met. The following paragraphs provide supplemental information.

Note: *The instructions in this paragraph are to be used when testing a separate ADLP. When testing a transponder with integral ADLP, refer to the instructions contained in RTCA/DO-160D in each test procedure.*

Table 2-9 Conformance Matrix

MOPS TEST PROCEDURE					MOPS REQUIREMENTS – PARAGRAPHS 2.1 AND 2.2											
ENVIRONMENTAL REFERENCE	2.4.3.1.1	2.4.3.1.2	2.4.3.1.3	2.4.3.1.4	2.1.8	2.1.9	2.1.11	2.2.1	2.2.3.2	2.2.3.2.1.1	2.2.4.1	2.2.4.2	2.2.4.3	2.2.4.4	2.2.4.5	2.2.4.6
LOW OPERATING	X					X	X	X			X					
TEMPERATURE		X								X					X	
DO-160D			X						X			X	X	X		X
PP 4.5.1				X	X											
HIGH OPERATING	X					X	X	X			X					
TEMPERATURE		X								X					X	
DO-160D			X						X			X	X			
PP 4.5.2,4.5.3.,4.5.4				X												
ALTITUDE TESTS	X					X	X	X								
DO-160D																
PP 4.6.1																
				X	X						X					
DECOMPRESSION						X	X	X								
DO-160D																
PP 4.6.2																
(WHEN REQUIRED)				X	X						X					
OVERPRESSURE	X					X	X	X								
DO-160D																
PP 4.6.3																
(WHEN REQUIRED)				X	X						X					
TEMPERATURE	X					X	X	X			X					
VARIATION		X								X					X	
DO-160D			X						X			X	X	X		X
SECT. 5.0				X	X											
HUMIDITY TEST	X					X	X	X								
DO-160D																
SECT. 6.0																
				X	X						X					
SHOCK TESTS	X					X	X	X								
OPERATIONAL																
DO-160D																
PP 7.2				X	X						X					
VIBRATION TESTS	X					X	X	X			X					
DO-160D		X								X					X	
SECT 8.0			X						X				X			X

MOPS TEST PROCEDURE					MOPS REQUIREMENTS – PARAGRAPHS 2.1 AND 2.2											
ENVIRONMENTAL REFERENCE	2.4.3.1	2.4.3.1.2	2.4.3.1.3	2.4.3.1.4	2.1.8	2.1.9	2.1.11	2.2.1	2.2.3.2	2.2.3.2.11	2.2.4.1	2.2.4.2	2.2.4.3	2.2.4.4	2.2.4.5	2.2.4.6
WATERPROOFNESS	X					X	X	X			X					
DRIP PROOF																
DO-160D PP 10.3.1																
(WHEN REQUIRED)				X	X											
WATERPROOFNESS	X					X	X	X			X					
SPRAY PROOF TEST																
DO-160D PP 10.3.2																
(WHEN REQUIRED)				X	X											
FLUIDS SUSCEPTIBILITY	X					X	X	X			X					
SPRAY TEST																
DO-160D PP 11.4.1																
(WHEN REQUIRED)				X	X											
IMMERSION TEST	X					X	X	X			X					
DO-160D																
PP 11.4.2																
(WHEN REQUIRED)				X	X											
SAND & DUST TEST	X					X	X	X			X					
DO-160D																
SECT. 12.0																
(WHEN REQUIRED)				X	X											
FUNGUS RESIST	X					X	X	X			X					
DO-160D																
SECT'. 13.0																
(WHEN REQUIRED)				X	X											
SALT SPRAY TEST	X					X	X	X			X				X	
DO-160D		X								X		X	X	X		X
SECT 4.0			X						X							
(WHEN REQUIRED)				X	X											
MAGNETIC EFFECT	X					X	X	X			X					
DO-160D																
SECT 15.0																
(WHEN REQUIRED)																
POWER INPUT' TESTS						X	X	X			X					
NORMAL OPERATING																
COND. D0-160D			X						X			X	X	X		X
PP 16.5.1, 16.52=.2				X	X											

MOPS TEST PROCEDURE					MOPS REQUIREMENTS – PARAGRAPHS 2.1 AND 2.2											
ENVIRONMENTAL REFERENCE	2.4.3.1	2.4.3.1.2	2.4.3.1.3	2.4.3.1.4	2.1.8	2.1.9	2.1.11	2.2.1	2.2.3.2	2.2.3.2.11	2.2.4.1	2.2.4.2	2.2.4.3	2.2.4.4	2.2.4.5	2.2.4.6
ABNORMAL	X					X	X	X			X					
OPERATING COND.		X								X					X	
DO-160D			X						X			X	X	X		X
PP 16.5.3, 16.5.4				X	X											
VOLTAGE SPIKE	X					X	X	X			X					
TEST CAT. A		X								X					X.	
DO- 160D PP 17.3			X						X			X	X	X		X
(IF APPLICABLE)				X	X											
CATEGORY B	X					X	X	X			X					
DO-160D		X								X					X,	
PP 17.4.1, 17.4.2			X						X			X	X	X		X
(IF APPLICABLE)				X	X											
AF CONDUCTED	X					X	X	X			X					
SUSCEPTABILITY		X								X					X	
DO-160D			X						X			X	X	X		X
SECT. 18.0				X	X											
INDUCED SIGNAL	X					X	X	X			X					
SUSCEPTABILITY		X								X					X	
DO-160D			X													
SECT. 19.0				X	X											
RF SUSCEPTABILITY	X					X	X	X			X					
RADIATED & COND.		X								X					X	
DO-160D			X						X			X	X	X		X
SECT. 20				X	X											
RF EMISSION	X					X	X	X			X					
DO-160D																
SECT 23 1.0																
				X	X											
LIGHTNING INDUCED	X					X	X	X			X					
TRANSIENT SUSCEPT.																
DO-160D SECT. 22.0																
CATEGORY AS REQ'D																

2.3.4.1 Spray Test (Ref. RTCA/DO-160D, Section 11.0)

The equipment shall be subjected to the test conditions as specified in RTCA/DO-160D, Subsection 11.4.1. In addition the following requirements shall be met:

a. At the end of the 24-hour exposure period, the equipment shall function.

b. Following the 2-hour operational period at ambient temperature, after the 150-hour exposure period at elevated temperature, the corresponding requirements of this standard shall be met.

2.3.4.2 Immersion Test (Ref. RTCA/DO-160D, Section 11.0)

The equipment shall be subjected to the test conditions as specified in RTCA/DO-160D, Subsection 11.4.2. In addition the following requirements shall be met:

a. At the end of the 24-hour exposure period, the equipment shall function.

b. Following the 2-hour operational period at ambient temperature, after the 150-hour exposure period at elevated temperature, the corresponding requirements of this standard shall be met.

2.3.4.3 Abnormal Operating Conditions (Ref. RTCA/DO-160D, Section 16.0)

The application of the Low Voltage Conditions (DC) (Category B Equipment) test may result in damage to the equipment under test. Therefore, this test may be conducted after the other tests have been completed. Subsection 2.1.7 "Effects of Test" does not apply.

The equipment shall be subjected to the test conditions as specified in RTCA/DO-160D, Subsections 16.5.3 and 16.5.4, by using the test sequence specified in paragraph 2.4.3.1.

<u>Note:</u> *In RTCA/DO-160D paragraph 16.5.3.2, allow the low voltage limit to go to zero for at least 0.5 seconds, thereby simulating full power loss.*

2.4 Equipment Test Procedures

This subsection defines a succession of test procedures beginning with an abbreviated procedure for use during the environmental qualification, a more comprehensive procedure to validate the ADLP message handling and, then, a comprehensive logical state test. Test definitions and results may be used by manufacturers as design guidance, in preparation of installation checkout procedures or for monitoring manufacturing compliance.

2.4.1 Definitions of Terms and Conditions of Test

The following are definitions of terms and the conditions under which the following tests should be conducted.

2.4.1.1 Power Input Voltage

Unless otherwise specified, all tests shall be conducted with the power input voltage adjusted to design voltage plus or minus 2%. The input voltage shall be measured at the input terminals of the equipment under test.

2.4.1.2 Power Input Frequency

a. In the case of equipment designed for operation from an AC source of essentially constant frequency (e.g., 400 Hz), the input frequency shall be adjusted to design frequency plus or minus 2%.

b. In the case of equipment designed for operation from an AC source of variable frequency (e.g., 300 to 1,000 Hz), unless otherwise specified, tests shall be conducted with the input frequency adjusted to within 5% of a selected frequency and within the range for which the equipment is designed.

2.4.1.3 Adjustment of Equipment

The circuits of the equipment under test shall be properly aligned and otherwise adjusted in accordance with the manufacturer's recommended practices prior to application of the specified tests. Unless otherwise specified, no adjustments may be made once the test procedures have started.

2.4.1.3.1 The Use of ISO 8208 Default Parameters

Unless otherwise specified, this procedure assumes that relevant parameters of the DTE/DCE interface are set to their standard default values as defined in ISO 8208 (Ref. 2). These include, but are not limited to, packet sizes, flow control window sizes, timers and retry counters.

2.4.1.3.2 Maintaining Flow Control

Unless otherwise specified, the tester shall ensure that flow control is maintained across the ADLP/HLE interface and the ADLP/GDLP interface. Flow control may be maintained through the use of RECEIVE READY Packets, or DATA Packets with updated PR/PS Subfields.

2.4.1.3.3 Network Conditions

Unless otherwise specified, the following test procedures assume that only one DTE will be connected to the ADLP during a given test. Failure to observe this precaution may cause test results to differ from the expected values.

2.4.1.3.4 Maintaining the II Code/DTE Cross Reference Table

Entries in the table are maintained by periodic surveillance or Comm-A messages. If surveillance or Comm-A messages are not received within Ts seconds of the previous message from a sensor, the II Code/DTE table entries for that sensor will be deleted.

It is important, therefore, when running the ADLP test sequence, that no lapse of activity longer than Ts seconds occurs between test Steps. If a lapse does occur, the desired test results may not be achieved. If test setup times are longer than Ts seconds, the table may be maintained by uplinking surveillance interrogations to the ADLP. Surveillance interrogations will. not affect the ADLP logical states, but will maintain the II, Code/DTE table as long as desired. For more information regarding the composition of surveillance messages refer to paragraph 2.4.1.8.2 of this MOPS.

Some of the following tests require the creation of multiple II Code/DTE entries via the ROUTE Packet. Unless otherwise stated, these entries shall be maintained.

2.4.1.4 Equipment Configuration

Replacement or substitution of components or circuit modules within the equipment under test is not permitted once the test procedures have started.

The ADLP shall undergo all testing with its OFP installed (Ref. 1). The software version number shall reflect the latest revision of the OFP that is intended for aircraft use.

The tests specified in this document are designed for an ADLP residing inside the transponder as well as an ADLP having an external interface to the transponder.

It is possible to combine portions of the transponder and ADLP test procedures. Advice on how to accomplish this is provided in notes in each of the ADLP test procedures.

Unless otherwise specified in a particular test section, the ADLP shall be required to send or receive messages to or from a full ELM Capable transponder. Indication shall be provided such that the ADLP senses the ELM capability.

2.4.1.5 Test Equipment

All equipment used in the performance of the tests should be identified by make, model and serial number where appropriate, and its latest calibration date. The specification of the accuracy of the test equipment is left to the calibration process prescribed by the agency which certifies the testing facility.

2.4.1.6 Test Equipment Precautions

During the tests:

a. Precautions shall be taken to prevent the introduction of errors resulting from the connection of test instruments across the, input and/or output, or measurement points of the equipment under test.

b. If used to terminate the input or output of the equipment under test, the test instruments shall present the equivalent impedance to the equipment under test for which it was designed. Otherwise, the equipment under test shall be Connected to loads having the impedance values for which it was designed.

2.4.1.7 Ambient Condition

Unless otherwise specified, all tests shall be conducted under conditions of ambient room temperature, pressure and humidity. However, the room temperature shall not be lower than 10 degrees C, and the relative humidity shall not be greater than 85%.

2.4.1.8 Standard Test Signals

The ADLP/HLE interface must conform to ISO 8208 (Ref. 2).

Note: *In the case of the ADLP being separate from the transponder, the manufacturer is free to choose any physical data bus for connection from the ADLP to the transponder. The manufacturer is also free to choose any physical data bus to the*

HLE regardless where the ADLP is hosted. All requirements of Subsection 2.1.8 must be met. Characteristics such as amplitude, timing, and waveform shapes of test signals applied to the ADLP shall be consistent with the standards definition of the selected data bus. Moreover, the manufacturer should adhere to system impedance requirements of the appropriate standards whether the equipment under test has power applied or not, or is in an active or quiescent state (i.e., standby). This consideration insures that the requirements of Subsection 2.1.12 will be met.

2.4.1.8.1 General Characteristics – ADLP/HLE Test Signals

a. Data Formats: Data transmitted across this interface shall be in packets conforming to standard ISO 8208.

b. Electrical Characteristics: Test signals on this interface shall be consistent with the appropriate standards for the connecting data bus.

c. ISO 8208 Channel Assignments: The test procedures in this MOPS use 15 ISO 8208 SVCs in the range 316 through 330. This assignment of SVCs is introduced as a documentation aid. The manufacturer is free to choose any block of 15 ISO 8208 SVCs in the range 1 through 4095, in a particular ADLP implementation.

d. Data Content: The test equipment shall be capable of generating or accepting messages with the following content: Packet fields such as sequence numbers, addresses, packet types or any other control fields shall be capable of being loaded with all ones or zeros or any combinations thereof. Data fields within the packets shall also be capable of being loaded with all ones or zeros or any combination thereof as specified in the test procedures.

2.4.1.8.2 General Characteristics – ADLP/Transponder Test Signals

a. Data Formats: With the possible exception of the 24-bit AP Field, the test equipment shall be capable of generating the entire content of long and short Mode S uplink messages and accepting the entire content of long and short downlink messages according to the following:

(1) Long Mode S messages are 112 bits, encoded per RTCA/DO-181C (Ref. 3), Subsections 2.2.14 and 2.2.17. Short Mode S messages are 56 bits, also coded according to RTCA/DO-181C (Ref. 3), Subsections 2.2.14 and 2.2.17. When required, the coding of these messages is contained in the appropriate test procedure of this MOPS.

(2) For uplink ELMs, the test equipment shall be able to convey a control field called Interrogator Identification Subfield (IIS) to the ADLP independently of the messages described in (1) above.

(3) The test equipment shall be able to convey delivery status of Mode S downlink messages to the ADLP independently of the messages described in (1) above.

(4) The test equipment shall be able to accept from the ADLP a Mode S frame cancellation message independently of the messages described in (1) above.

(5) The test equipment shall be able to convey a control field to the ADLP, independently of the messages described in (1) above, to indicate the transponder data link capability.

(6) The test equipment shall accept indication of the frame type (i.e., Comm-A, broadcast, etc.) being generated by the ADLP. Provision may be made to accept the frame indication either independently of, or by means of the messages described in (1) above.

Note: *A manufacturer may wish to incorporate a Mode S transponder and ADLP in a single package. In such a case it may be more expedient to apply test signals to the transponder RF input and monitor receipt of test signals at the RF output rather than at the transponder/ADLP interface. The requirements outlined in (1) through (6) above apply, with the exception that the 24-bit AP Field (subparagraph a) is now required.*

b. Electrical Characteristics: Test signals on this interface shall be consistent with the appropriate standards for the connecting data bus, if test signals are to be injected into the ADLP input terminals. If test signals are to be injected into the transponder's RF port (see previous note), the requirements in Subsections 2.1.11 and 2.2.4 of RTCA/DO-181C (Ref. 3) shall be met.

c. Data Content: The test equipment shall be capable of generating or accepting messages with the following data content Control fields and message fields in the Mode S frames shall be capable of containing all ones or all zeros or any combination thereof as specified in the test procedures.

2.4.1.9 Message Validation

The test equipment shall provide a means of validating the information content of any message received from the ADLP. This requirement applies to either the GDLP test set interface or the HLE test set interface.

2.4.1.10 Power Up – Initialization

When the ADLP first receives power, it attempts to initialize its routing table by issuing a SEARCH request. The expected response is a ROUTE Packet. For details regarding the ROUTE procedure, see paragraph 2.4.4.4.1 of this document. Several times during these procedures, it is necessary to restart the ADLP. If power is removed to do so, it will be necessary to reinitialize the table.

2.4.2 Required Test Equipment

Note 1: *Several protocol adapters are commercially available as circuit cards to be installed in desktop or mainframe computer systems. These devices are suitable for generating ISO 8208 packets.*

a. ISO 8208 Test Set: Commercially available equipment (or equivalent) which conforms to the requirements of Subsection 2.4.1.

b. Data Generator: Hewlett Packard 8018A Serial Data Generator or equivalent; used for GDLP data generation.

c. Oscilloscope: Tektronix 7904 or equivalent; used for viewing data bus waveshapes.

d. Network Analyzer: Hewlett Packard 8175A or equivalent; used for time delay measurements and for decoding pulse streams at the transponder/RF interface.

Note 2: Items b and d are specialized test equipment required for the high integrity data measurements required by this standard.

2.4.3 Subset Test Procedures

This paragraph defines a subset of the comprehensive test procedure to be performed in conjunction with RTCA/DO-160D in lieu of the comprehensive test procedure when the ADLP is built as a stand-alone unit. Judgment and experience with integrated circuitry motivated the development of the subset as containing the minimum number of tests required to adequately qualify the ADLP environmental performance.

Note: Normally, the extreme environment testing is conducted after the nominal environment test sequence has been successfully completed. This MOPS is organized such that the extreme environmental procedures are described first (Subsection 2.4.3), before the (nominal) detailed test procedures (Subsection 2.4.4). This organization is not intended to imply an order of testing; it is intended to link the environmental requirements (Subsection 2.3) with the appropriate test procedures (Subsection 2.4.3). It is expected that the manufacturers will run the nominal test sequence before running the extreme environmental test sequence.

2.4.3.1 Test Procedure to be Used in Environmental Qualification

Equipment Required

ISO 8208 Test Set
Data Generator
Oscilloscope
Network Analyzer

Measurement Procedure

With the equipment connected as shown in Figure 2-5, follow the procedures in paragraphs 2.4.3.1.1 through 2.4.3.1.4.

The environmental test procedures are designed to execute the major functions of the ADLP. A series of ISO 8208 and Mode S packets will be transferred across the ADLP interfaces to stimulate the logical states. The table below shows the required input and output for each step of this test. Entries in the table are denoted either "ISO 8208" or "Mode S." ISO 8208 refers to transactions at the FILE interface and Mode S refers to transactions at the GDLP/RF interface.

The ISO 8208 test set will be used to perform the HLE functions and will be referred to as the FILE throughout these tests. The data generator and network analyzer will be used to perform the transponder/GDLP functions and will be referred to as the GDLP throughout these tests.

Tests that refer to the Separate Interface (for the Mode S Specific Services) will require a separate data generator/receiver that meets the requirements of the Separate Interface. The Separate Interface will be referred to as HLE/SI in the following paragraphs.

The following packet transactions are required for the Environmental Test Procedures contained in paragraphs 2.4.3.1.1 through 2.4.3.1.4:

ADLP INPUT	ADLP OUTPUT
1. ISO 8208 CALL REQUEST	Mode S CALL REQUEST
2. Mode S CALL ACCEPT	ISO 8208 CALL ACCEPT
3. ISO 8208 DATA	Mode S DATA
4. None	ISO 8208 RECEIVE READY
5. ISO 8208 CLEAR REQUEST	ISO 8208 CLEAR CONF. Mode S CLEAR REQUEST
6. Mode S CLEAR CONF.	None
7. ISO 8208 RESET REQUEST	ISO 8208 RESET CONF. Mode S RESET REQUEST
8. Mode S RESET CONF.	None
9. ISO 8208 RESTART REQUEST	ISO 8208 RESTART CONF. Mode S CLEAR REQUEST
10. ISO 8208 DATA	None
11. Mode S RECEIVE NOT READY	None
12. Mode S RECEIVE READY	Mode S DATA
13. Mode S DATA (invalid PS)	Mode S REJECT
14, ISO 8208 INTERRUPT	Mode S INTERRUPT
15. Mode S INTERRUPT CONE	ISO 8208 INTERRUPT CONE
16. ISO 8208 RECEIVE READY	None
17. Mode S ROUTE	None
18. Mode S DATA	ISO 8208 DATA

Unless otherwise noted, each transaction in the table must be completed within 0.25 seconds. This requirement shall be verified in each test.

Note: *If the ADLP environmental test sequence is to be performed in conjunction with the transponder tests, refer to paragraphs 2.3.2.11.3 and 2.3.2.11.4 in RTCA/DO-181C (Ref. 3). These two test sections qualify the indirect data interfaces and ELM service interfaces to the level of environmental testing defined as groups one and two of RTCA/DO-181C (Ref. 3). The tests for these interfaces stipulate data patterns that are to be loaded into either the transponder interface or into the message fields of the stimulus Mode S packets. Rather than the stipulated data patterns, load the ADLP interface or Mode S frames, as appropriate, with the data patterns as specified in paragraphs 2.4.3.1.1 through 2.4.3.1.4 in this document.*

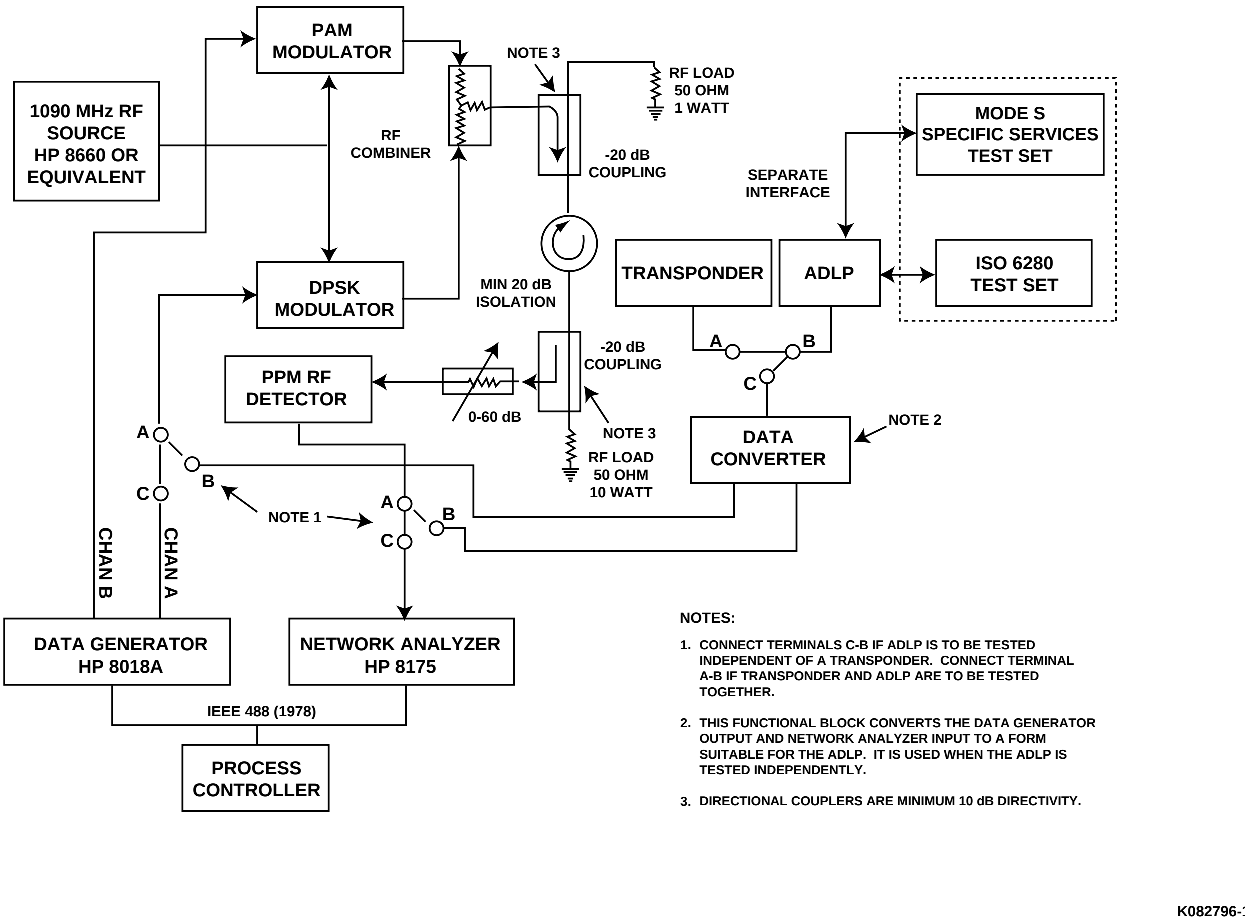


Figure 2-5 ADLP Test Configuration

2.4.3.1.1 Environmental Test Procedure 1

The ADLP is required to execute a built in test (BIT) sequence automatically when power is applied (Subsection 2.2.10 of this document). The ADLP shall initiate its OFP software only after a successful BIT sequence. The test implementor has an immediate indicator of the ADLP condition by the presence of the SEARCH request after system power is applied. This indication is especially important in the environmental test sequence where an undetected ADLP failure would result in wasted time running test procedures on equipment installed in a test chamber.

Step 1 – Initialization

Before executing this test, clear the ADLP by cycling power (power off at least 10 seconds). After power is restored, the ADLP will send out a SEARCH request in a broadcast mode. Accept a Mode S frame containing a Mode S ROUTE Packet, causing the ADLP to initialize the II Code/DTE cross reference table, to match at least two sensors with a single ground DTE address.

Step 2 – Virtual Call Setup

This test uses transactions 1 and 2. From the HLE, generate an ISO 8208 CALL REQUEST packet to the ADLP. At the GDLP, verify that a Mode S CALL ACCEPT packet is received from the ADLP. From the GDLP, generate the corresponding Mode S CALL ACCEPT packet back to the ADLP. At the HLE, verify that an ISO 8208 CALL ACCEPT packet is received from the ADLP for the appropriate SVC.

Step 3 – Data Transmission Procedures

This test uses Transactions 3 and 4. Send two ISO 8208 DATA Packets to the ADLP on the open SVC. Each DATA Packet has M-bit set to zero. Maintain flow control for the SVC, (i.e., the PS Subfields for the first and second packet should be zero and one, respectively). Fill the User Data (UD) Field with 20 bytes of data, to fit into one Comm-B frame, and fill the UD fields with alternate one-zero patterns.

For each ISO 8208 DATA packet generated by the HLE, verify at the GDLP that Mode S DATA packets are received. Also, verify at the HLE interface, that ISO 8208 RECEIVE READY packets are received from the ADLP as required by transaction 4.

Step 4 – Clear Request Procedures

This test uses transactions 5 and 6. Form the HLE, generate an ISO 8208 CLEAR REQUEST packet to the ADLP. Verify that an ISO 8208 CLEAR CONFIRMATION packet is received from the ADLP. At the GDLP, verify that a Mode S CLEAR REQUEST packet is received from the ADLP. Then, from the GDLP, generate a Mode S CLEAR CONFIRMATION packet back to the ADLP. Verify at the HLE interface that there is no related output.

2.4.3.1.2 Environmental Test Procedure 2

Perform the procedures in paragraph 2.4.3.1.1 Step 2 to open two SVCs.

Step 1 – Reset Procedure

This test uses transactions 7 and 8. Send an ISO 8208 RESET REQUEST on one of the open SVCs. At the HLE, verify that the ADLP has returned an ISO 8208 RESET CONFIRMATION. Also, at the GDLP, verify that a Mode S RESET REQUEST has been sent by the ADLP on the correct Mode S SVC. From the GDLP, return the corresponding Mode S RESET CONFIRMATION. Verify that there is no other output to the HLE.

Step 2 – Restart Procedure

This test uses Transactions 9 and 6. Send an ISO RESTART REQUEST. At the HLE, verify that an ISO 8208 RESTART CONFIRMATION has been returned from the ADLP. At the GDLP, verify that Mode S CLEAR REQUEST packets were generated by the ADLP on both of the open SVCs. Also, from the GDLP, return two Mode S CLEAR CONFIRMATION packets back to the ADLP for the appropriate channels.
Verify that there is no other output at the HLE interface.

2.4.3.1.3 Environmental Test Procedure 3

Perform Steps 2 and 3 in paragraph 2.4.3.1.1 to open an SVC and begin data transfer.

Step 1 – Receive Not Ready Procedure

This test uses Transactions 11 and 10. Send a Mode S RECEIVE NOT READY Packet to the ADLP. Send an ISO 8208 DATA Packet to the ADLP. Verify that there is no related output at the GDLP.

Step 2 – Receive Ready Procedure

This test uses transaction 12. From the GDLP, send a Mode S RECEIVE READY packet to the ADLP. At the GDLP, verify that the ADLP has returned a Mode S DATA packet back and that the data content is the same as in the ISO DATA packet sent in Step 1.

Step 3 – Reject Procedures

This test uses Transaction 13. Send a Mode S DATA Packet with PS Subfield equal to any value except zero. At the GDLP, verify that a Mode S REJECT packet was generated by the ADLP and that the PR Subfield within the Mode S REJECT packet is set to zero.

Step 4 – Interrupt Procedures

Send an ISO 8208 DATA Packet to the ADLP with User Data containing 128 bytes and M-bit set to 1. Send a 20 byte ISO 8208 INTERRUPT Packet followed by another ISO 8208 DATA Packet to the ADLP with M-bit set to 0 this time and a User Data Field containing 10 bytes of data.

At the GDLP, verify that the Mode S INTERRUPT packet is received first before the Mode S contructed DATA packet. Send a Mode S INTERRUPT CONFIRMATION packet to the ADLP. At the HLE, verify that an ISO 8208 INTERRUPT CONFIRMATION packet is generated by the ADLP. Also, verify that ISO 8208 RECEIVE READY packets are received at the HLE as appropriate.

Step 5 – Clear Channel

This test uses Transactions 5 and 6. Perform the procedures in paragraph 2.4.3.1.1 Step 4 to clear the SVC.

2.4.3.1.4 Environmental Test Procedure 4

Perform the procedures in paragraph 2.4.3.1.1 Step 2 to open an SVC.

Step 1 – Data Integrity

This test uses transactions 3 and 18. Generate 8 ISO 8208 DATA packets (M-bit=0) with UD field length of 125 bytes. The value of each byte in the UD field of the first packet is zero, the second packet is one, and so on. From the GDLP test set, generate 8 Mode S DATA packets with a user data field of 24 bytes and the same data pattern as in the above.

a. Verify that flow control is maintained at the HLE interface by the receipt of ISO 8208 RECEIVE READY packets generated from the ADLP. Also verify that the GDLP received the related Mode S DATA packets generated by the ADLP.

Note: *If DATA Packets are used to update the flow control windows, it is permissible to update after every ISO 8208 DATA Packet.*

b. Verify that the DATA packets received at the HLE and at the GDLP are reformatted correctly and that the UD fields are in correct order and content.

Step 2 – System Timer Test Procedures

This test uses transactions 3, 17, and a SEARCH REQUEST. Prepare the ADLP as described in paragraph 2.4.3.1.1 Steps 1 and 2. Note, use II code pair 1 and 2 with ground DTEs 6 and 7 for this test.

From the HLE test set, prepare 2 ISO 8208 DATA packets for generation to the ADLP. The first DATA packet will contain 7 bytes of user data with each byte having the value of 1, while the second DATA packet will also contain 7 bytes of user data each containing the value of 2.

Now, generate the first ISO 8208 DATA packet to the ADLP. At the GDLP test set, verify the receipt of the reformatted Mode S DATA packet for correctness via the II code 1. Now, generate the second ISO 8208 DATA packet to the ADLP, but from the RF generator, do not send a closeout for this message. Wait Tz time to allow for the ADLP to cancel the original Mode S frame and attempt to resend the message via the second Mode S sensor referenced in the II/DTE cross reference table (II=2) in the ADLP (from ROUTE packet). Now, from the RF generator send the proper closeout within the Tz time frame and verify that the GDLP test set receives this Mode S DATA packet via the correct interrogator (II=2).

Perform the clear request procedures as in paragraph 2.4.3.1.1 Step 4.

2.4.4 Detailed Test Procedures

The test procedures set forth below constitute a satisfactory method of determining required ADLP performance. Although specific test procedures are cited, it is recognized that other methods may be preferred. Such alternate methods may be used if the manufacturer can show that they provide at least equivalent information. Therefore, the procedures cited herein should be used as one criterion in evaluating the acceptability of the alternate procedures.

2.4.4.1 Mode S Specific Services Tests

Equipment Required

ISO 8208 Test Set Data Generator (HP 8018A or equivalent) Network Analyzer (HP 8175A or equivalent)

Measurement Procedure

Connect the equipment as shown in Figure 2-5. Transmit digital data from the data generator (GDLP) to the ADLP, and use the ISO 8208 test set (HLE) to generate and verify the correct ISO 8208 packets. Tests that refer to the Separate Interface (for the Mode S specific services) will require a separate data generator/receiver that meets the requirements of the Separate Interface. The Separate Interface will be referred to as HLE/SI in the following paragraphs.

2.4.4.1.1 Downlink Processing

(2.2.6.1.1.2 – Broadcast Processing)
(2.2.6.1.1.3 – GICB Processing)
(2.2.6.1.1.4 – MSP Processing)

Broadcast Processing

Apply power to the Unit Under Test (UUT), and verify that a successful system initialization occurs (i.e., verify the BIT status after power is applied).

Verify that the transponder generates a broadcast Comm-B containing a SEARCH request. Generate two 56 bit downlink broadcast messages. The 56-bit message data field will consist of an alternating one-zero pattern and alternating zero-one pattern for alternate packets. Send the two broadcast messages to the ADLP from the HLE/SL Allow 20 seconds to elapse between transmission of each message.

Verify that the transponder generates two broadcast Comm-B segments whose MB Fields are exactly equal to the message data fields of the broadcast messages.

Generate a downlink broadcast message from the HLE/SI with the data field length greater than 56 bits. Verify that the UUT sends an error message to the HLE/SI and that no request for a Comm-B downlink appears at the RF interface.

If this test is to be performed in conjunction with the transponder testing, follow procedure #21a in RTCA/DO-181C (Ref. 3). At the point in the B-protocol test procedure where the broadcast DR codes are to be entered, perform the first part of this step with the following differences:

1. Send as many broadcast messages to the ADLP as the number of interface patterns required in RTCA/DO-181C (Ref. 3). The requirement to synchronize interrogations (see measurement procedure) the broadcast messages applies in this test.

2. The broadcast messages are to contain the control information described in this step, but the message fields will contain the interface pattern data as required in RTCA/DO-181C (Ref. 3).

Verify that the transponder returns a reply with DR = 4 or 5, not more than 0.25 seconds after the broadcast message was sent to the ADLP.

Verify also, that the subsequent reply contains an MB Field exactly equal to the message data field of the broadcast message.

GICB Processing

Generate 256 Ground Initiated Comm-B messages. The control data for the first message will contain register number = 0, and each subsequent message will contain a register number incremented by one. The last message will contain register number = 255. The register range constitutes a positive test by exercising all of the ground-initiated transfers available to the GDLP alternate interface (GDLP/AI) in addition to register numbers that are invalid as a negative test.

Send the 256 GICB messages to the ADLP from the HLE/SI. Verify that the ADLP accepts all 256 messages but sends control commands to the transponder to load only transponder registers 5 through 47 and 49 through 255. Verify that the load command for each register appears at the transponder/ADLP interface within 0.25 seconds after the ADLP receives corresponding GICB message. Also verify that the, MB Field generated by the ADLP is identical to the message data field of the corresponding GICB message.

Step 1 – Generate a GICB message from the HLE/SI containing a uniquely recognizable 56 bit data field and send it the UUT. Extract the contents of the GICB register and verify the data field.

Step 2 – Using the same GICB register number as in Step 1, generate a GICB message containing a different uniquely recognizable pattern from Step 1 and greater than 56 bits and sent it to the UUT. Verify that the UUT send an error message to the HLE/SI and, after extraction, the data field is unchanged from Step 1.

Note: *If this test is to be performed in conjunction with the transponder testing, follow procedure #18 in RTCA/DO-181C (Ref. 3). Procedure #18 includes six interrogation patterns designed to elicit ground-initiated extractions. These patterns are 2, 5, 8, 14, 17, and 20. Each of these patterns must be exercised with each of 63 transponder states, for a total of 378 interrogations. This test will use any combination of 256 out of the possible 378 messages, provided that all six interrogation patterns are used.*

The requirement to synchronize interrogations (see measurement procedure) to GICB messages applies in this test.

Negative GICB Test

In the above procedure, data for all implemented GICB registers was sent to the UUT. However, register numbers 0 (air-initiated and Comm-B broadcast), 15 and 48 (TCAS) should not be changed by loading GICB data in the ADLP. Extract data from registers 0, 1, 15 and 48, and verify that the data initially loaded into the registers by the previous test is not present.

MSP Processing

(2.2.5.3.2 – Delivery Status)
(2.2.5.3.9.1 – Application)
(2.2.5.3.9.2 – Procedure)
(2.2.6.2.1 – Short Form MSP Packet)
(2.2.6.2.2 – Long Form MSP Packet)

This test requires the transmission Short and Long Form Mode S Specific Protocol (MSP) packets over several Mode S MSP channels.

Force the UUT to have “SLM only” capability.

Uniquely identify the UD fields of each MSP packet by using recognizable sequences of bit and/or byte patterns. One method for uniquely identifying each packet for this test is to insert the MSP channel number in the UD Field.

Send the following MSP packets to the ADLP from the HLE/SI:

Group	No of Packets	UD Field Length	Packet Size	MSP Channel Numbers
a.	8	5 bytes	1 segments	48-41
b.	4	12 bytes	2 segments	52-49
c.	4	19 bytes	3 segments	56-53
d.	4	26 bytes	4 segments	60-57
e.	3	29 bytes	see text	63-61
f.	-	165 bytes	-	61

For groups a. through d., extract all Comm-B segments, and follow each with a closeout, as necessary. Verify that the control codes are DP=0, MP=0 (indicating the Short form MSP) and M/CH field corresponds to the selected MSP packet group (M/CH=48 to 41 for group a., M/CH = 52 to 49 for group b., etc.). Verify that the UUT sends the status of each downlink to the HLE/SI.

Note: *The packet from group e is oversize and cannot be transmitted in entirety. This portion of the test requires the ADLP to use Long Form MSP packets with L-bit assembly.*

Verify that the first Comm-B message contains 26 bytes of user data identical to the first 26 bytes of the UD Field in the original MSP message, and the L-bit is set. Verify that the second Comm-B message contains one segment with the MB Field identical to the last three bytes of user data in the original MSP message, and the L-bit is not set.

Send the data from group f to the ADLP. Verify that no request for Comm-B downlink appears at the UUT RF interface.

Force the UUT to report 'downlink ELM' capability.

Repeat the group e test described in the previous paragraph with the condition that the oversize packets are to be sent in total using downlink ELMO containing Short MSP packets.

Note: *If this test is to be performed in connection with transponder testing, follow procedure #18 of paragraph 2.5.4.18 in RTCA/DO-181C (Ref. 3). Interrogations 14, 17 and 20 may be used to extract the multisegmented messages. Interrogations 3, 6 and 21 may be used to extract the single segment packets. Verify the Mode S packet control codes, UD Field content and length, channel sequencing, downlink ELM and oversize packet processing using L-bit procedures.*

2.4.4.1.2 Uplink Processing

(2.2.6.1.2.2 – Broadcast Processing)
(2.2.6.1.2.3 – MSP Processing)
(2.2.5.3.3 – Interrogator Identifier)

Broadcast Processing

Send twelve uplink Comm-A Broadcast messages divided into two groups of six interrogations. The first group will be uplinked with a UF Field = 20 and the second group with UF = 21. Within each group of six interrogations, the 56 bit MA fields will contain a combination of the following bit patterns: all ones, all zeros, alternating ones and zeros and alternating zeros and ones. For each frame, set DI = 1 or 7, IIS = 15, and SD (except IIS) = 0, and provide an indication that the frame is an unlinked Comm-A (LAS = 0).

Verify that the data delivered to the HLE/SI contains the 56 bits of data in the MA field, the 32 bits Mode S frame header information, the II code, the broadcast ID and an indication that the frames are Comm-A broadcast frames."

Note: *If this test is to be performed in conjunction with a Mode S transponder, use transponder test procedure #15 defined in paragraph 2.5.4.15 of RTCA/DO-181C (Ref 3). Use any 12 of the interrogations required in RTCA/DO-181C (Ref. 3) to perform the ADLP test. Pack the data fields of the interrogation with the field contents shown in the text above. Use UF 20 and 21 (if the transponder is so equipped). Use the UD fields specified in the above text, or ensure that all of the bits in the message field are toggled on and off at least once for each of the UF codes.*

MSP Processing

(2.2.6.2.1 – Short Form MSP Packet)
(2.2.6.2.2 – Long Form MSP Packet)

This test uplinks several packets on different Mode S MSP channel numbers The ADLP is required to reformat Short and Long MSP packets into message and control data for the HLE/SI.

Uniquely identify the UD fields of each MSP packet by using recognizable sequences of bit and/or byte patterns. One method for uniquely identifying each packet for this test is to insert the MSP channel number in the UD Field.

Send the following MSP messages to the ADLP from the GDLP/AI:

Group	No of Packets	UD Field Length	Packet Size	MSP Channel Numbers
a.	8	6 bytes	1 segments	48-41
b.	4	13 bytes	2 segments	52-49
c.	4	20 bytes	3 segments	56-53
d.	4	27 bytes	4 segments	60-57
e.	3	29 bytes	see text	63-61

Verify that the ADLP forwards the contents of the UD fields, as well as a means for identifying the packets as MSP data, to the HLE/SI.

In case e), send to the ADLP 2 Mode S linked Comm-A frames containing 2 linked Mode S Long Form MSP Packet on the selected MSP channel number. The first packet will have L-bit set to one and contain 26 bytes of user data. The second frame will have L-bit set to zero and contain 3 bytes of user data. Make sure the ADLP forwards the contents of the UD Field in its entirety and correct order to the HLE/SI.

If the UUT is ELM uplink capable, repeat Step e) but this time send a Mode S Short Form MSP packet to the ADLP containing 29 bytes of data in the UD Field. Verify that the ADLP forwards the contents of the UD Field as a means for identifying the packet as MSP data, to the HLE/Sl.

2.4.4.2 Frame Tests

2.4.4.2.1 Uplink SLM Frames

(2.2.5. 1.1 – SLM Frame)
(2.2.5. 1.1.1 – SD Field)
(2.2.5.1.1.2 – LAS Coding)
(2.2.5.1.1.3 – Unlinked SLM Frame)
(2.2.5.1.1.4 – Linked SLM Frame)

Unlinked SLM Frame

Clear the UUT by cycling power for at least 10 seconds. From the GDLP/AI, generate 4 unlinked Comm-A frames containing Mode S Short Form MSP Packets having uniquely identifiable data in each of the 6 byte UD fields. Send this data to the UUT using MSP Channel Number 48 for the first frame, 47 for the second frames, etc. and use II = 6 for all frames.

Verify that the ADLP accepts control and message data from the transponder interface indicating 4 unlinked Comm-A segments with IIS = 6 and LAS = 0 in each case.

Verify also that the ADLP forwards the content of the UD Field to the HLE/SI as well as a means for identifying the packets as MSP data, to the HLE/SI.

Note: *If this test is to be performed in conjunction with Mode S transponder validation, the message field must be duplicated exactly in the Mode S RF interrogation, and uplink formats 20 and 21 must both be used.*

SD Field
LAS Coding
Frame Cancellation
Linked SLM Frame

This test requires the transmission of linked Comm-A segments over MSP channels.
In order for the ADLP to reformat the frames, it is necessary to have segment number one contain the Short Form MSP Packet header.
Linked Comm-A messages can be canceled either whole or in part if the segments are not correctly received as determined by the LAS Field.

Generate the following table of uplink frame data. Uniquely identify the data in the MA fields of each segment by using recognizable sequences of bit and/or byte patterns. All segments should be delivered by the same sensor II code, that is sensor 1, except frames 13 and 15 which should be delivered by sensor number 2.

Send the following sequence of frames to the ADLP:

LAS CODING

Frame	1	2	3	4	5	6	
1.	1	0	0	0	1	0	Initial and final segments.
2.	0	1	1	1	0	0	Two intermediate and one final segment; no initial segment.
3.	1	1	0	0	0	1	Initial intermediate and final segments.
4.	1	1	1	0	0	0	Initial and intermediate segments; no final segment.
5.	1	0	0	0	0	1	Initial, third/final segments, no second segment.
6.	1	1	1	0	0	0	Initial and intermediates; no final segment.
7.	0	0	0	0	0	0	Delay Tc plus one second.
8.	0	0	0	1	0	0	Final segment for frame 6.
9.	1	1	1	0	0	0	Initial and intermediate segments.
10.	0	0	1	1	0	0	Duplicate and final segment for frame 9.
11.	1	1	1	1	0	0	All 4 segments complete.
12.	1	0	0	0	0	0	Initial segment IIS=1.
13.	1	0	0	0	0	0	Initial segment IIS=2.
14.	0	0	0	0	1	0	Final segment IIS=1.
15.	0	0	0	0	1	0	Final segment IIS=2.
16.	1	0	0	0	0	1	First and final segment.
17.	0	1	0	0	0	0	Second segment.

Send each frame at 10-second intervals, except frame 7. After sending frame 6, wait at least Tc plus one seconds before sending frame 8. Thereafter, continue with 10-second intervals.

Verify that frames 1, 3, 11, 12/14, 13/15, and 16/17 are sent to the HLE/SI. Verify the 0.25 second reformatting time requirement and the data content for completeness and proper order.

Frames 9 and 10 should comprise a complete linked Comm-A. However, segment 3 is duplicated in frame 10 and should be discarded. Verify that frames 9 and 10 are sent to the HLE/SI. Verify from the length and content that the duplicate segment has been discarded.

Frames 2, 4, 5, 6 and 8 should all be discarded; no message data should result. Each of these frames meets one of the conditions of paragraph 2.2.5.1.1.4 for uplink frame cancellation.

Link Frame Cancellation Timer Tc

Generate two Short Form MSP packets with a 27 byte UD Field to fit into a four segment linked Comm-A message. The content of the UD Field will be a 1 in the first byte, 2 in the second byte, etc. Set II = 1 for all segments.

Send only the first three Comm-A segments of the first frame to the ADLP. Impose a delay of Tc minus two seconds, then send the final segment.

Verify that the ADLP forwards to the HLE/SI a MSP message with a 27-byte UD Field in correct order and content.

Repeat the process just described and transmit the first three Comm-A segments of the second frame. However, this time impose a delay of Tc plus two seconds between the transmission of the third and the final Comm-A segments. Verify that there is no output to the HLE/Sl.

2.4.4.2.2 Uplink ELM Frames

(2.2.5.1.2 – ELM Frames)

This test is intended to demonstrate that the ADLP can receive segments of an ELM. ELM protocol is strictly a transponder issue; the ADLP has no part in the message handling until the transponder sends a complete ELM.

The data content of each of the segments of the ELM will be identical to the transponder MC Fields after the receipt of an ELM. The bit pattern contained in the MC Field should permit each segment's data to be uniquely identified. Note that the first four bits of each uplink ELM MC Field contains the II code of the sensor. Therefore, there are 76 bits of User Data in each uplink ELM segment.

All segments should be delivered by the same sensor 1, code.

Send the following table of ELM frames (UF = 24) containing the Short Form of MSP packets, to the ADLP at the transponder interface:

Group	No of Packets	UD Field Length	Packet Size	MSP Channel Numbers
a.	1	18 bytes	2 segments	2
b.	1	27 bytes	3 segments	3
c.	1	37 bytes	4 segments	4
d.	1	46 bytes	5 segments	5
e.	1	56 bytes	6 segments	6
f.	1	65 bytes	7 segments	7
g.	1	75 bytes	8 segments	8
h.	1	84 bytes	9 segments	9
i.	1	94 bytes	10 segments	10
j.	1	103 bytes	11 segments	11
k.	1	113 bytes	12 segments	12
1.	1	122 bytes	13 segments	13
m.	1	132 bytes	14 segments	14
n.	1	141 bytes	15 segments'	15
o.	1	151 bytes	16 segments	16

Verify also that the ADLP forwards the contents of the UD fields of the MSP packets and a means for identifying the packet as MSP data, to the HLE/SI.

<u>Negative Uplink ELM Frame Test</u>

The ADLP must discard the entire uplink ELM if all of the segments do not contain the same II code.

Repeat the previous test with data from group a of the test but send the last segment with an II code different from the II code contained in the first segment.

Verify that no output is generated to the HLE/SI.

<u>*Notes:*</u>

1. *If the ADLP is integral to a non-uplink ELM capable transponder, this test will be performed using linked Comm-A frames with M-bits set to construct the 152 byte Mode S packet.*

2. *If this test is to be performed in conjunction with a transponder test, use procedure #25 in paragraph 2.5.4.25 of RTCA/DO-181C (Ref. 3). Use any of the 6320 patterns specified with the condition that MC be as defined above.*

2.4.4.2.3 Downlink SLM Frames

(2.2.5.2.1.1 – LBS Coding)
(2.2.5.2.1.2 – Linking Protocol)
(2.2.5.2.1.3 – Directing SLM Frames)
(2.2.5.3.2 – Delivery Status)
(2.2.5.3.4 – Mode S Protocol Type Identification)
(2.2.5.3.6 – Frame Determination)

This test requires the transmission single and linked Comm-B segments over MSP channels.

Force the UUT to support ‘SLM only’ capability.
Uniquely identify the UD fields of each MSP packet by using recognizable sequences of bit and/or byte patterns. One method for uniquely identifying each packet for this test is to insert the MSP channel number in the UD Field. Set II = 1 for all packets in this section.

Send the following MSP messages to the ADLP from the HLE/SI:

Group	No. of Packets	UD Field Length	Packet Size	MSP Channel Numbers
a.	8	5 bytes	1 segments	48-41
b.	4	12 bytes	2 segments	52-49
c.	4	19 bytes	3 segments	56-53
d.	4	26 bytes	4 segments	60-57
e.	3	29 bytes	see text	63-61

Extract each Comm-B segments from the UUT and send Comm-D close-outs, as necessary. Verify the UUT sends an indication of the downlink delivery status to the HLE/SI. Verify the correct association of LBS value with the number of segments delivered and that the M/CH field decrements correctly.

Since the transponder is not downlink ELM capable, the packets from group e will be sent via Comm-B segments with MSP L-bit procedures.

Verify that the first Comm-B message from group e consists of 4 segments and contains 26 bytes of data in the MB Field(s) and that the second Comm-B message contains one segment with three bytes of data in the MB Field.

2.4.4.2.4 Downlink ELM Frames

(2.2.5.2.2.1 – Procedure)
(2.2.5.2.2.2 – Directing ELM Frames)

This test requires the transmission of ELM segments over MSP channels.

Force the UUT to support “downlink ELM capability.”

Uniquely identify the UD fields of each MSP packet by using recognizable sequences of bit and/or byte patterns. One method for uniquely identifying each packet for this test is to insert the MSP channel number in the UD Field.

Send the following MSP messages to the ADLP from the HLE/SI:

Group	No of Packets	UD Field Length	Packet Size	MSP Channel Nubers
a.	1	9 bytes	1 segment	1
b.	1	19 bytes	2 segments	2
c.	1	29 bytes	3 segments	3
d.	1	39 bytes	4 segments	4
e.	1	49 bytes	5 segments	5
f.	1	59 bytes	6 segments	6
g.	1	69 bytes	7 segments	7
h.	1	79 bytes	8 segments	8
i.	1	89 bytes	9 segments	9
j.	1	99 bytes	10 segments	10
k.	1	109 bytes	11 segments	11
1.	1	119 bytes	12 segments	12
m.	1	129 bytes	13 segments	13
n.	1	139 bytes	14 segments	14
o.	1	149 bytes	15 segments	15
p.	1	159 bytes	16 segments	16

Extract the Comm-D segments from the UUT and send Comm-D close-outs, as necessary. Verify the UUT sends an indication of the downlink delivery status to the HLE/SI. At the GDLP/AI test set, verify the correct association of the ND value with the number of segments delivered and that the M/CH field increments correctly for each packet.

2.4.4.3 Frame Processing Tests

(2.2.5.3.5 – Frame Cancellation)
(2.2.5.3.8 – Multiplexing)
(2.2.5.3.9 – Mode S Channel Sequence Preservation)

Frame Cancellation

This test verifies the ADLP's ability to cancel downlink frames transferred to the transponder for which a message closeout has not been indicated. This test also verifies the ADLP's ability to selectively cancel a Mode S frame waiting for transmission to the ground.

Send a MSP message to the ADLP from the HLE/SI maintaining the message small enough to fit into one Comm-B frame.

After Tz plus one second, send another MSP message to the ADLP from the HLE/Sl. Keep also this message small enough to fit into one Comm-B frame.

Before Tz seconds from the moment the second MSP message was sent, send a message closeout to the ADLP to extract the frames.

At this point, it assumed that the ADLP will cancel the first Comm-B frame due to the timeout. Verify that this cancellation occurs, and verify also that the second frame has been transferred successfully.

Multiplexing

This test verifies the ADLP's ability to multiplex Mode S packets when multiple Mode S packets are awaiting transfer to the same GDLP.

Perform the Call Setup procedures as specified in paragraph 2.4.3.1.1 Step 2 to open an SVC. At this point provide capability to the Transponder to be in a busy mode. Generate 3 ISO 8208 DATA packets each having a User Data field of 3 bytes. The ADLP will reformat these packets into Mode S DATA packets and prepare them for transmission to the GDLP, at which point, the ADLP will detect the presence of the Transponder being in a busy mode and will then place these packets into a local queue for possible multiplexing purposes.

Now, provide capability to the Transponder such that it is no longer in a busy mode. At the GDLP, verify that a Mode S MULTIPLEX packet is received from the ADLP comprised of all 3 Mode S DATA packets previously being stored in the local queue. Also, verify that the multiplex packet is formatted as follows:

(1 byte) multiplex header.
(1 byte) length of the 1st DATA packet.
(7 bytes) DATA packet User Data field plus header.
(1 byte) length of the 2nd DATA packet.
(7 bytes) DATA packet User Data field plus header.
(1 byte) length of the 3rd DATA packet.
(7 bytes) DATA packet User Data field plus header.
(1 byte) length of zero, end of frame.

Verify the Mode S DATA packets for correct content and order.

Perform the Clear Request procedures as specified in paragraph 2.4.3.1.1 Step 4 for the open SVC.

Mode S Channel Sequence Preservation

(Paragraph 2.2.5.3.9.2 – Procedure)

Open three SVCs, generate three Mode S Receive Not Ready Packets to the ADLP, one Packet per SVC. This condition will prevent the ADLP from transmitting DATA Packets until Mode S Receive Ready Packets are received from the GDLP. Send 15 ISO 8208 DATA Packets (per open SVC) to the ADLP at the HLE/ADLP interface. Generate three Mode S Receive Ready Packets and message closeouts as necessary to the ADLP to begin SVC data transfer. Verify that the order of the data waiting to be transferred is transmitted to the GDLP in the same order in which is was received trough their respective SVCs.

Resequencing and Duplication

(Paragraph 2.2.4.9)
(Paragraph 2.2.4.9.4 – Transmission Functions)
(Paragraph 2.2.4.9.5.2 – Packets in duplication window)
(Paragraph 2.2.4.9.5.3, – Packets in resequencing window)
(Paragraph 2.2.4.9.5.4 – Release Packets to the ADCE)

(Paragraph 2.2.4.9.6 – Tq Timer Expiration)

The following tests ensure the reliability of the resequencing algorithm between the ADCE and the Frame Processing function. Resequencing occurs independently on the uplink for each SVC.

Transmission Functions.

The first part of this test (a) verifies the ADLP's ability to increment the Mode S packet's SN field for every transmission or retransmission (modulo 64). The second part of this test (b) verifies the ADLP's ability to manage the timeout event (Tz) for those unacknowledged packets.

a) Perform the Call Setup procedures as specified in paragraph 2.4.3.1.1, Step 2 to open an SVC.

Generate 64 ISO 8208 DATA packets each having a User Data field of 5 bytes filled with AA (hex).

Verify that Mode S packets are delivered in incremental order (modulo 64) to the GDLP. Verify that Mode S packets 1 through 63 contain SN=1 through SN=63 accordingly, and Mode S packet number 64 contains SN=0.

Perform the Clear Request procedure as specified in paragraph 2.4.3.1.1 Step 4.

Note: *The second part of this test is verified within 2.4.4.7 under section "Interrogator Link Timer (Tz) test."*

Packets in duplication window

This test verifies the actions taken by the ADLP when a packet is received within the duplication window of the resequencer.

Perform the Call Setup procedures as in paragraph 2.4.3.1.1 Step 2 to open an SVC.

Use the GDLP generator to uplink 5 Mode S DATA packets on the open SVC to the ADLP starting with the sequence number subfield two. This will force the ADLP to hold these packets in the window since the packet with the sequence number subfield of one is missing. Generate another DATA packet (#6) to the ADLP with the same sequence number as packet #5. Now, generate another DATA packet (#7) from the GDLP to the ADLP with sequence number subfield of one.

Note: *All uplinked packets must be generated within the Tq time period.*

At the HLE, verify that a total of six ISO 8208 DATA packets were generated by the ADLP since one packet was discarded by the ADLP for duplication of sequence numbers.

Perform the Clear Request procedures as in paragraph 2.4.3.1.1 Step 4 for the open SVC.

Packets in the resequencing window

This test verifies the ability of the ADLP to resequence packets which were out of order within Tq time limits.

Perform Call Setup procedures as in paragraph 2.4.3.1.1 Step 2 to open an SVC.

Use the GDLP generator to uplink 5 Mode S DATA packets on the open SVC to the ADLP with the sequence number subfield out of order (As in: 1, 3, 2, 5, 4) within the Tq time period. At the HLE, verify that the DATA packets are received in correct order and format from the ADLP.

Perform the Clear Request procedures as in paragraph 2.4.3.1.1 Step 4 for the open SVC.

Release Packets to the ADCE

This test verifies the normal actions taken by the ADLP when packets are received in sequence order.

Perform Call Setup procedures as in paragraph 2.4.3.1.1 Step 2 to open an SVC.

Use the GDLP generator to uplink 5 Mode S DATA packets on the open SVC to the ADLP with the sequence number subfield all in order (as in: 1, 2, 3, 4, 5). At the HLE, verify that the DATA packets are received in sequence with the correct format and data content.

Perform the Clear Request procedures as in paragraph 2.4.3.1.1 Step 4 for the open SVC.

Tq Timer Expiration

This test verifies the Tq timer expiration actions taken by the ADLP for s-bit linked Mode S packets and non s-bit linked Mode S packets.

Step 1 – S bit Linked Packets.

CALL REQUEST packet by GDLP.

Generate a Mode S CALL REQUEST packet with Fast Select with no restriction on the response from the GDLP test set to the ADLP. At this point, the ADLP will start its Tq timer countdown since this packet is part of an incomplete s-bit sequence. Allow for 60 seconds or more to elapse, then verify that there is no output at the ADLP/HLE interface, since this packet's Tq timer expired causing the entire s-bit sequence to be discarded internally be the ADLP.

CALL ACCEPT packet by GDLP.

Generate an ISO 8208 CALL REQUEST packet from the HLE to the ADLP with the Fast Select option with no restriction on the response. Uplink a Mode S CALL ACCEPT packet from the GDLP with s-bit set to 1 and f-bit set to 0. At this point, the ADLP will start its Tq timer countdown since this packet is part of an incomplete s-bit sequence. Allow for 60 seconds or more to elapse, then verify that there is no output at the ADLP/HLE interface, since this packet's Tq timer expired causing the entire s-bit sequence to be discarded internally be the ADLP. Note, at this point, the ADLP DCE is in a p2 state and the ADLP ADCE is in a p3 state, and by remaining in the ADCE p3 state for Tx time, a link failure procedure will be generated automatically by the ADLP and eventually clear the opened SVC for this test.

INTERRUPT packet by GDLP.

Perform the Call Setup procedures as specified in paragraph 2.4.3.1.1 Step 2 to open an SVC.

From the GDLP test set, generate a Mode S INTERRUPT packet to the ADLP with s-bit set to one and f-bit set to zero. At this point, the ADLP will start its Tq timer countdown since this packet is part of an incomplete s-bit sequence. Allow for 60 seconds or more to elapse, then verify that there is no output at the ADLP/HLE interface, since this packet's Tq timer expired causing the entire s-bit sequence to be discarded internally be the ADLP.

Perform the Clear Request procedures as specified in paragraph 2.4.3.1.1 Step 4 for the open SVC.

CLEAR REQUEST packet by GDLP.

Generate an ISO 8208 CALL REQUEST packet from the HLE to the ADLP with the Fast Select option with no restriction on the response. Uplink a total of 2 Mode S CALL ACCEPT packets within Tq time limits. The first CALL ACCEPT will have s-bit set to 1 and f-bit set to 0, the second CALL ACCEPT packet will have s-bit set to 0 and f-bit set to 1 to complete the packet sequence. At the HLE, verify that an ISO 8208 CALL ACCEPT packet is received from the ADLP.

From the GDLP test set, generate a Mode S CLEAR REQUEST packet to the ADLP with s-bit set to one and f-bit set to zero. At this point, the ADLP will start its Tq timer countdown since this packet is part of an incomplete s-bit sequence. Allow for 60 seconds or more to elapse, then verify that there is no output at the ADLP/HLE interface, since this packet's Tq timer expired causing the entire s-bit sequence to be discarded internally be the ADLP.

Step 2 – Non S bit Linked Packets.

Perform the Call Setup procedures as specified in paragraph 2.4.3.1.1 Step 2 to open an SVC.

Generate 5 Mode S DATA packets from the GDLP on the open channel to the ADLP. Allow the first and second DATA packets to have sequence numbers in sequence order SN = 1 and SN = 2. At the HLE, verify that two ISO 8208 Data packets are received from the ADLP. Then, generate the third DATA packet from the GDLP to the ADLP with sequence number out of order SN = 4, send the fourth DATA packet with SN = 5. At this point, we are missing packet with SN = 3 and Tq has been started for this packet, packet SN=4 and SN=5 are now being stored. Allow for 60 seconds or more to elapse before continuing with any further test, this will allow for Tq timer to expire for the missing packet with SN=3. Verify that the GDLP receives a Mode S REJECT packet from the ADLP indicating the value of the PR for which retransmission of the Mode S DATA packet is to begin. The REJECT packet occurred since the PS count was incorrect in the previously released packets to the ADCE when Tq expired.

Perform the Clear Request procedures as specified in paragraph 2.4.3.1.1 Step 4 for the open SVC.

2.4.4.4 Mode S Subnetwork Management Tests

(2.2.7.1 – Interrogator Link Determination Function)

2.4.4.4.1 Interrogator Link Determination Function

(2.2.7.1.1 – General)
(2.2.7.1.2 – Protocol)
(2.2.7.1.3 – Procedures for Downlinking Mode S Packets)

This test is designed to validate the ability of the ADLP to maintain and update (as necessary) an II code/DTE cross reference table. There are three conditions which must be tested:

1. ADLP power up initialization or ADLP receives ROUTE Packet with added entries.

2. ADLP loses contact with current sensor (timeout).

3. ADLP receives ROUTE Packet with Deleted entries.

Step 1 – ADLP Power Up Initialization

Remove power to the ADLP for at least 10 seconds, then reapply power to the ADLP. Verify that the GDLP receives a SEARCH REQUEST packet from the ADLP.

From the GDLP test set, uplink a Mode S ROUTE packet to the ADLP with the following information: II code 1 with ground DTE 7, and II code 2 with ground DTE 7. This adds the pairs to the ADLP's II/DTE cross reference table for ground DTE reachability information.

Step 2 – ADLP Loses Contact with Current Sensor (Timeout)

From the HLE test set, generate ISO 8208 CALL REQUEST packets to the ADLP, the packet will have called DTE address set to 7. Verify that the GDLP test set receives the proper Mode S CALL REQUEST packet from the ADLP with the correct ground DTE field set. Return the appropriate Mode S CALL ACCEPT packet back to the ADLP. At the HLE test set, verify that an ISO 8208 CALL ACCEPT packet is received from the ADLP.

Now, send an ISO 8208 DATA packet to the ADLP. The ADLP will attempt to downlink this message via II code 1 or 2 for DTE pair 7 based on availability. At the RF test set, do not send a closeout for this message within Tz seconds, allowing the downlink frame to time out. At this point the ADLP will attempt to downlink the same message via an alternative path based on the II/STE cross reference table; that is, it will select II code 2 for the DTE pair 7. At the RF test set, send the appropriate closeout for this downlink within the time-out period.

At the GDLP test set, verify that the Mode S DATA packet is received from II code 2.

Perform the clear request procedures as in paragraph 2.4.3.1.1 Step 4.

<u>Step 3 – ADLP Receives ROUTE Packet with Deleted Entries</u>

From the GDLP test set, uplink a Mode S ROUTE packet to the ADLP with the following information: delete II code 1 with ground DTE 7, and II code 2 with ground DTE 7. This information forces the ADLP to delete those entries in the II/DTE cross reference table.

To verify that DTE 7 is no longer reachable through any II code, generate an ISO 8208 CALL REQUEST packet for ground DTE 7 to the ADLP. At the HLW test set, verify that the ADLP clears this SVC since DTE 7 was previously deleted from the ROUTE packet.

<u>Procedure for downlinking Mode S packets</u>

From the GDLP test set, uplink a Mode S ROUTE packet to the ADLP with the following information: pairing code 1 and 2 with ground DTE 7.

From the HLE test set, send an ISO 8208 CALL REQUEST packet to the ADLP with the called DTE set to 7. This packet will be downlinked as air directed by the ADLP. From the GDLP test set return a Mode S CALL ACCEPT packet to the ADLP. At the HLE, verify the receipt of the ISO CALL ACCEPT packet from the ADLP.

Send an ISO 8208 DATA packet to the ADLP containing 10 bytes of user data. At the GDLP, verify the receipt of the Mode S DATA packet from the ADLP with the same data as originated from the HLE test set. At the RF test set, cease surveillance for the II code used in the previous two downlinks for a period of Ts plus one seconds. This action will cause the II code to be removed from the II code/DTE cross reference table.

Send another ISO 8208 DATA packet to the ADLP on the same SVC used in the previous step. The ADLP will downlink this frame as an air-directed message, but the second II code entry for the ground DTE is used (II=2).

Perform the clear request procedures as in paragraph 2.4.3.1.1 Step 4.

2.4.4.4.2 Subnetwork Initialization After GDLP Recovery

This test verifies the ADLP's ability to perform initialization functions based on information carried in the Mode S ROUTE packet's Initialization Bit (IN) field. The initialization procedure causes the ADLP to clear all open SVC channels to that GDLP/DTE. This is needed to assure that all open channels to that GDLP are closed following recovery after a GDLP failure.

Power up the ADLP and generate a Mode S SEARCH REQUEST. From the GDLP test generator, uplink a Mode S ROUTE packet to the ADLP containing a DTE address of 115 and the IN bit set to ONE.

At this point, the ADLP will add the DTE address to its II code/DTE cross reference table for connectivity information and will check for any open SVCs to this DTE for possible local initialization actions based on the IN bit setting.

Now, perform the call setup procedures as specified in paragraph 2.4.3.1.1 Step 2 to open an SVC.

Generate another Mode S ROUTE packet from the GDLP test set with the IN bit set to 1 to the ADLP (simulating a GDLP failure recovery procedure). Upon receipt of this Mode S ROUTE packet, the ADLP will perform the necessary local initialization actions by clearing the previously opened SVC associated with the GDLP/DTE carried in the Mode S ROUTE packet. The ADLP's actions will include (1) releasing all allocated resources associated with that SVC, (2) internally, it will return the SVC to the ADCE state p1, and (3) it will send an ISO 8208 CLEAR REQUEST packet to the HLE. At the HLE, verify that the ISO 8208 CLEAR REQUEST packet is received, then return an ISO 8208 CLEAR CONFIRMATION back to the ADLP, thus returning that SVC in the ADLP to the DCE p1 state.

2.4.4.4.3 ADLP Connectivity Reporting

The following test procedure verifies the ADLP's ability to perform Subnetwork Management Events (SNME) to the connected airborne DTE for the reporting of ground DTE reachability information.

After ADLP power up, generate a Mode S ROUTE packet from the GDLP generator containing DTE address 115.

Perform the call setup procedures as specified in paragraph 2.4.3.1.1 Step 2 to open an SVC.

At this point, the airborne DTE has knowledge of the ground DTE address via the ISO 8208 CALL REQUEST packet's DTE address calling field.

Now, simulate a link failure in the ADLP by powering off the transponder. After the frame processing interface detects the unavailability of the transponder, the ADLP will send DTE reachability information (in the form of a leave event) to the airborne DTE through the use of an ISO 8208 DATA packet containing the ground DTE address (115) of the GDLP that is no longer reachable.

Verify that this is the case.

2.4.4.5 Data Link Capability Report

(2.2.8.1 – Format)
(2.2.8.2 – Protocol)

Extract the Data Link Capability Message from the ADLP.

Verify that the Label and the Mode S Subnetwork Version are correct and uplink and downlink ELM capability subfields accurately report the capabilities of the transponder. Jumper the transponder interface to produce at least two other reports in the uplink ELM and downlink ELM capability subfields.
If TCAS is not connected during this test, verify that bits reserved for TCAS (bits 16, 37, 38) all remain zero.

<u>Note:</u> *If this test is to be performed in conjunction with transponder testing, use Section 2.5.4.2.0 procedure #20 in RTCA/DO-181C (Ref. 3).*

2.4.4.6 Buffer Capacity

(Paragraph 2.2.3.1.1)

Note: *This test is designed to test minimum requirements. If a manufacturer chooses to build an ADLP with extra buffer space, the ADLP may send a RECEIVE READY Packet to allow more downlink or uplink DATA Packets to be sent. This is an acceptable deviation from this test, and it is not necessary to downlink or uplink additional Packets. However, the remainder of the test must be followed.*

This test verifies the ADLP's ability to buffer 15 DATA plus 1 INTERRUPT packet in the uplink and downlink direction per SVC, for 15 Mode S SVCs.

Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2 to open 15 SVCs. From the HLE, generate ISO 8208 RECEIVE NOT READY packets to the ADLP on each of the open SVCs. From the GDLP, generate Mode S RECEIVE NOT READY packets to the ADLP on each of the open SVCs. Also, from the GDLP, uplink 15 Mode S DATA packets (containing 25 bytes of UD) to the ADLP on each of the open SVCs.

During the GDLP data transfer, the HLE interface will not begin to deliver ISO 8208 RECEIVE READY packets to the ADLP. Verify that this is the case at the HLE.

Now, downlink 15 ISO 8208 DATA packets (containing 125 bytes of UD) to the ADLP for delivery to the GDLP for each of the open SVCs.

Verify that there is no related output at the GDLP.

Uplink a Mode S INTERRUPT packet (containing 25 bytes of UD) from the GDLP to the ADLP on each of the open SVCs. Likewise, downlink an ISO 8208 INTERRUPT packet (containing 32 bytes of UD) from the HLE to the ADLP on each of the open SVCs.

From the HLE, generate the necessary ISO 8208 RECEIVE READY packets on the open SVCs to the ADLP and, thereby, providing a "dump" of the uplink packets stroed in the ADLP. Verify that all the DATA packets are received at the HLE along with the INTERRUPT packet origianally generated by the GDLP. Verify that these packets are reformatted correctly and have the correct data content.

From the GDLP, generate the necessary Mode S RECEIVE READY packets on the open SVCs to the ADLP thus providing a "dump" of the downlink packets stored in the ADLP. Verify that all the DATA packets are received at the GDLP along with the INTERRUPT packet originally generated by the HLE. Verify that these packets are reformatted correctly and have the correct data content.

Perform the clear request procedures as in paragraph 2.4.3.1.1 Step 4 for all the open SVCs.

2.4.4.7 System Timer Tests

(Paragraph 2.2.9)

Interrogator Link Timer (Tz)

Perform the call setup procedure in paragraph 2.4.3.1.1 Step 2 to open an SVC. From the HLE test set, generate an ISO 8208 DATA packet to the ADLP. From the RF test set, do not send a closeout to the ADLP for this downlink. This will force the Tz timer in the ADLP to start its countdown for the non-closeout action. After 30 seconds elapse, verify at the HLE that an ISO 8208 CLEAR REQUEST packet is received from the ADLP with clearing cause set to 137 and diagnostic code set to 255. Return an ISO 8208 CLEAR CONFIRMATION packet back to the ADLP. At this point, knowing the ADLP has received an ISO CLEAR REQUEST packet from the HLE test (which would normally set the ADLP's DCE state for that channel back to p1) the SVC at the ADLP's DCE side remains on probation (not cleared completely) until the channel retirement (Tr) timer expires.

Channel Retirement Timer (Tr)

Since the detection of the link failure (from previous Tz test), Generate an ISO 8208 CALL REQUEST packet from the HLE in an attempt to re-open the same SVC within 600 seconds since the link failure occurred. At the GDLP, verify that there is no related Mode S CALL REQUEST packet, since the ADLP has discarded the ISO 8208 CALL REQUEST because the ADLP's DCE state for the SVC remains in probation status (i.e., not yet cleared, p7 state) from the original link failure actions. Once the 600 seconds elapse, attempt to re-open the same SVC from the HLE, and verify that a successful call setup is completed (channel opens end to end).

Active Channel Timer (Tx)

The following tests verify the use of the ADLP's inactivity timer (Tx).

Step 1 – Inactivity After REJECT

With the SVC still open from the Tr timer tests, generate a Mode S DATA packet from the GDLP test set to the ADLP with an invalid PS field. At the GDLP, verify that a Mode S REJECT packet is received from the ADLP. Now, cease any activity for this SVC for Tx seconds. After Tx seconds elapse, verify at the GDLP, that the ADLP has reissued the Mode S REJECT packet for the GDLP.

Now, respond to the ADLP with a proper DATA packet with the correct PS field.

Step 2 – Inactivity After RR, RNR and DATA

From the HLE test set, generate an ISO 8208 DATA packet to the ADLP. Cease any activity for this SVC for Tx seconds. After Tx seconds elapse, verify at the GDLP, that either a Mode S DATA, RR or RNR is received from the ADLP for that SVC.

Perform the clear request procedures as specified in paragraph 2.4.3.1.1 Step 4 to clear the open channel.

Active Channel Determination (Tx) Procedure for Other States

The following tests will verify the Tx timer procedures for other states such as: p2, p3, p7, d3.

Tx procedure for p2 state

From the HLE test set, generate an ISO 8208 CALL REQUEST packet to the ADLP. Do not resond with a Mode S CALL ACCEPT packet from the GDLP test set (this forces the ADLP's DCE states into p2). Cease any activity on this channel for Tx seconds. Then, verify the results as in the Interrogator Link Timer (Tz) procedure.

Tx procedure for p3 state

Use the GDLP data generator to send a Call Request to the HLE. Do not respond with an ISO 8208 Call Accept back to the ADLP (this forces the state to remain into p3). Cease activity to remain in this state to make Tx expire, once Tx has expired, verify the results as in the Interrogator Link Timer (Tz) procedure.

Tx procedure for p7 state

Perform the procedures as in paragraph 2.4.5.2.2 Step 6 parts "a" and "b" (this forces the state to be in p7). Cease activity to remain in this state to make Tx expire, once Tx has expired, verify the results as in the Interrogator Link Timer (Tz) procedure.

Tx procedure for d3 state

Perform the procedures as in paragraph 2.4.3.1.1 Step 2 to open an SVC. Send an ISO 8208 CLEAR CONFIRMATION Packet to the ADLP. At the HLE test set, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP, do not respond with an ISO 8208 Reset confirmation back to the ADLP (this forces the state to remain in d3). Cease activity to remain in this state to make Tx expire, once Tx has expired, verify the results as in the Interrogator Link Timer (Tz) procedure.

S-bit Delivery Timer (Tq)

Note 1: *This test is verified within paragraph 2.4.4.3 under Resequencing and Duplication.*

L-bit Delivery Timer (Tm)

From the GDLP/SI test set, create 2 long form MSP packets for delivery to the ADLP. The first packet will have 26 bytes of user control data and L-bit set to 1. The seconds packet will have 16 bytes of user control data and L-bit set to 0 for a complete sequence.

After sending the first packet, send the second packet within the Tm time period. At the HLE/SI test set, verify the receipt of this constructed packet containing 42 bytes of user control data in correct order and content.

Repeat the process to generate the long form MSP packets again to the ADLP, except this time, send the second packet after Tm time period. This allows the ADLP to discard the complete sequence since the expiration of the Tm timer for L-bit sequencing.
At the HLE/SI test set, verify that there is no related output for this transaction.

Link Failure Cancellation Timer (TO

Note 2: *This test is verified within paragraph 2.4.4.2.1.*

Packet Resequencing Timer (Tq)

Note 3: This test is verified within paragraph 2.4.4.3 under Resequencing and Duplication.

Interrogator Interrogation Timer (Ts)

Note 4: This test is verified within paragraph 2.4.4.4.1.

2.4.4.8 Use of Temporary and Permanent Channel Numbers

The following test procedure verifies the ADLP's ability to select the appropriate type of channel in use based on packet format information. The idea is to show precedence to the permanent channel when it is available (non-ZERO) and to use the temporary channel number when the CH field is set to ZERO for proper Mode S channel clearing purposes.

Generate a Mode S CALL REQUEST (#1) packet by GDLP with TC field set to 3. From the HLE test set, return an ISO 8208 CALL ACCEPT packet back to the ADLP. At the GDLP, verify that a Mode S CALL ACCEPT packet is received from the ADLP with CH set to 15 and TC set to 3.

From the GDLP test set, generate another Mode S CALL REQUEST (#2) packet with TC set to 3 (at this point, the ADLP has broken the TC/CH association). Do not return an ISO 8208 CALL ACCEPT for this request. Instead, generate an ISO 8208 CLEAR REQUEST from the HLE test set for this SVC. Internally, the ADLP will have set CH to 15 and TC to 3 for this CLEAR REQUEST packet from the HLE.

Verify that channel 15 associated with the Mode S CALL REQUEST (#1) by GDLP is the only channel to be cleared, (since the CLEAR REQUEST packet CH field is Non-zero, the TC field is ignored) and verify that a Mode S CLEAR CONFIRMATION by GDLP is sent to the ADLP with CH set to 15. Also, verify that an ISO 8208 CLEAR REQUEST was generated to the DTE/DCE interface and an ISO 8208 CLEAR CONFIRMATION is returned to the ADLP's DCE interface. Now, from the HLE test set, generate the ISO 8208 CALL ACCEPT packet in response to the CALL REQUEST (#2) packet by the GDLP. Internally, the ADLP will set CH to 15 and TC to 3 for the CALL ACCEPT packet to be sent to the GDLP.

Send another Mode S CALL REQUEST (#3) by GDLP with TC set to 3 (at this point the ADLP has broken the TC/CH association) and before responding with an ISO 8208 CALL ACCEPT packet back to the ADLP, generate an ISO 8208 CLEAR REQUEST packet for that SVC to the ADLP. The ADLP will set CH to 0 and TC to 3.

Verify that this call (#3) is cleared since the CH field is set to ZERO allowing precedence to the temporary channel number to be used and cleared. Also verify that a Mode S CLEAR CONFIRMATION by GDLP is sent to the ADLP with TC set to 3 and CH set to 0.

2.4.5 Channel State Test Procedures

The channel state test procedures are designed to test the restart, call setup and clearing, reset, interrupt, flow control and data transfer state tables of the ADLP. The tests are divided into two subgroups: the Normal State Test Procedures and the Error Recovery State Test Procedures.

Throughout these tests it is assumed that the transponder has no downlink ELM capability. Provide indication to the ADLP to this effect. Unless otherwise indicated, the tests all occur on one logical channel.

Note: *If the test set in Subsections 2.4.5 through 2.4.7 of this MOPS is to be performed in conjunction with a transponder test set, use transponder test procedure 15 (paragraph 2.5.4.15) and procedure 18 (paragraph 2.5.4.18) of RTCA/DO-181C (Ref. 3). Use procedure 15 for uplink packet delivery, and procedure 18 for downlink packet delivery. Use any interrogation in either procedure provided that (a) it was not used in a previous test and (b) the interrogation is appropriate given the current logical state of the transponder.*

Before executing this test, clear the ADLP by cycling power (power off at least 10 seconds). The ADLP will send out a SEARCH request in a broadcast mode. Return a Mode S frame containing a Mode S ROUTE Packet, causing the ADLP to initialize the II Code/DTE cross reference table.

2.4.5.1 Normal State Test Procedures

(Paragraph 2.2.2 – The DCE Operation)
(Paragraph 2.2.2.1 – State Transitions)

These procedures are designed to test the ADLP actions when receiving the logically correct packets for the state of the SVC. A series of ISO 8208 and Mode S packets will be transferred across the ADLP boundaries to stimulate the logical states.

The table below shows the required input and output for this test. Entries in the table are denoted either "ISO 8208" or "Mode S." ISO 8208 refers to transactions at the HLE interface, and Mode S refers to transactions at the transponder/GDLP interface.

Use the ISO 8208 test set to perform the HLE functions and the data generator and network analyzer to perform the transponder/GDLP functions.

The following packet transactions are required for the Normal State Test Procedures:

ADLP INPUT	ADLP OUTPUT
1. ISO 8208 CALL REQUEST	Mode S CALL REQUEST
2. Mode S CALL ACCEPT	ISO 8208 CALL ACCEPT
3. ISO 8208 DATA	Mode S DATA
4. None	ISO 8208 RECEIVE READY
5. ISO 8208 CLEAR REQUEST	ISO 8208 CLEAR CONF.
	Mode S CLEAR REQUEST
6. Mode S CLEAR CONF.	None
7. Mode S CALL REQUEST	ISO 8208 CALL REQUEST
8. ISO 8208 CALL ACCEPT	Mode S CALL ACCEPT
9. Mode S DATA	ISO 8208 DATA
10. Mode S CLEAR REQUEST	Mode S CLEAR CONF.
	ISO 8208 CLEAR REQUEST
11. ISO 8208 CLEAR CONF.	None
12. ISO 8208 CLEAR REQUEST	ISO 8208 CLEAR CONF.
13. ISO 8208 RESTART REQUEST	ISO 8208 RESTART CONF.
	Mode S CLEAR REQUEST
14. Mode S CLEAR CONF.	None
15. ISO 8208 RESTART CONF	ISO 8208 RESTART REQUEST
16. ISO 8208 RESTART CONF	None
17. ISO 8208 RESET REQUEST	ISO 8208 RESET CONF.
	Mode S RESET REQUEST
18. Mode S RESET CONF.	None
19. Mode S RESET REQUEST	Mode S RESET CONF.
	ISO 8208 RESET REQUEST
20. ISO 8208 RESET CONF.	None
21. ISO 8208 RESET REQUEST	None
22. Mode S RESET REQUEST	None
23. Mode S RECEIVE NOT READY	None
24. ISO 8208 DATA	None
25. Mode S RECEIVE READY	Mode S DATA
26. Invalid Mode S DATA	Mode S REJECT
27. ISO 8208 DATA	None
28. ISO 8208 INTERRUPT	Mode S INTERRUPT
29. ISO 8208 DATA	Mode S DATA
30. Mode S INTERRUPT CONF.	ISO 8208 INTERRUPT CONF.
31. SI CONTROL MESSAGE DATA	Mode S MSP
32. Mode S MSP (long & short)	SI CONTROL MESSAGE DATA
33. SI CONTROL MESSAGE DATA	Mode S MSP ISO 8208 RECEIVE READY
34. ISO 8208 CLEAR REQUEST	None
35. Mode S DATA	None
36. Mode S INTERRUPT	ISO 8208 INTERRUPT
31. Mode S DATA	ISO 8208 DATA
38. ISO 8208 INTERRUPT CONF.	Mode S INTERRUPT CONF.
39. ISO 8208 CALL REQUEST	Mode S CALL REQUEST
	ISO 8208 CALL REQUEST

2.4.5.1.1 Call Setup and Clearing States

Step 1 – Virtual Call Setup from HLE

This test uses Transactions 1 and 2. Perform the procedures in paragraph 2.4.3.1.1 Step 2 to open an SVC.

Steil 2 – Data Transmission

This test uses Transactions 3 and 4. Perform the procedures in paragraph 2.4.3.1.1 Step 3 to begin data transfer.

Step 3 – Clear Request Procedures from HLE

This test uses Transactions 5 and 6. Perform the procedures in paragraph 2.4.3.1.1 Step 4 to clear an SVC.

Step 4 – Virtual Call Setup from GDLP

This test uses transactions 7 and 8. Generate a Mode S CALL REQUEST packet form the GDLP to the ADLP. Set the TC subfield to 1 and the AG subfield to 15. At the HLE, verify that an ISO 8208 CALL REQUEST packet is received. Return an ISO 8208 CALL ACCEPT packet back to the ADLP. Verify that the GDLP received a Mode S CALL ACCEPT packet from the ADLP.

Step 5 – Data Transfer from the GDLP

This test uses transaction 9. Generate a Mode S DATA packet from the GDLP to the ADLP with 25 bytes of data. At the HLE, verify that an ISO 8208 DATA packet is received from the ADLP with the same data content as generated by the GDLP. Verify the data content for correctness.

Step 6 – GDLP Requests to Clear the Channel

This test uses transactions 10 and 11. Generate a Mode S CLEAR REQUEST packet from the GDLP to the ADLP. At the GDLP, verify the ADLP has returned a Mode S CLEAR CONFIRMATION packet back to the GDLP. At the HLE, verify that the ADLP has generated an ISO 8208 CLEAR REQUEST packet and return an ISO 8208 CLEAR CONFIRMATION packet back to the ADLP. Verify that there is no output at the ADLP/GDLP interface.

Step 7 – HLE Aborts a Call Request

This test uses transactions 1, 5 and 6. Send an ISO 8208 CALL REQUEST packet form the HLE to the ADLP. At the GDLP, verify that a Mode S CALL REQUEST packet is received from the ADLP. Now, from the HLE, generate an ISO 8208 CLEAR REQUEST packet to the ADLP for that SVC. At the HLE, verify that the ADLP has returned an ISO 8208 CLEAR CONFIRMATION for that SVC. Also, at the GDLP, verify that a Mode S CLEAR REQUEST packet is received from the ADLP, and return a Mode S CLEAR CONFIRMATION to the ADLP. Verfiy that there is no output at the ADLP HLE interface.

Step 8 – GDLP Aborts a Call Request

This test uses Transactions 7, 10 and 34. Send a Mode S frame containing a Mode S CALL REQUEST to the ADLP. Verify the resultant ISO 8208 CALL REQUEST. Send a Mode S frame containing a Mode S CLEAR REQUEST to the ADLP. At the GDLP, verify that a Mode S CLEAR CONFIRMATION packet is received from the ADLP. Verify the Clearing and Diagnostic Cause Fields in the ISO 8208 CLEAR REQUEST and to return an ISO 8208 CLEAR CONFIRMATION to the ADLP. Verify that there is no corresponding output on the ADLP/GDLP interface.

Step 9 – GDLP rejects a Call Request

This test uses transactions 1, 10 and 11. Send an ISO 8208 CALL REQUEST packet to the ADLP. At the GDLP, verify that a Mode S CALL REQUEST packet is received from the ADLP. Then, from the GDLP, return a Mode S CLEAR REQUEST packet back to the ADLP. At the HLE, verify that an ISO 8208 CLEAR REQUEST packet is received on that SVC from the ADLP, and return an ISO 8208 CLEAR CONFIRMATION on that SVC. At the GDLP, verify that a Mode S CLEAR CONFIRMATION packet has been received from the ADLP on the corresponding SVC.

Step 10 – HLE Rejects a Call Request

This test uses transactions 7, 5 and 6. Generate a Mode S CALL REQUEST packet from the GDLP to the ADLP. Form the HLE, return an ISO 8208 CLEAR REQUEST packet back to the ADLP. At the HLE, verify that an ISO 8208 CLEAR CONFIRMATION packet is received form the ADLP on that SVC. At the GDLP, verify that a Mode S CLEAR REQUEST packet is received from the ADLP, and generate a MODE S CLEAR confirmation packet back to the ADLP. Verify that there is no other output to the ADLP/HLE interface.

Step 11 – ISO 8208 CLEAR REQUEST for a Channel in the Ready State (p1)

This test uses Transaction 12. Send an ISO 8208 CLEAR REQUEST to the ADLP. At the HLE, verify that an ISO 8208 CLEAR CONFIRMATION is received form the ADLP on that SVC.

Step 12 – Call Collision

This test uses transactions 7 and 39. Generate a Mode S CALL REQUEST packet form the GDLP to the ADLP. At the HLE, verify the receipt of an ISO 8208 CALL REQUEST packet from the ADLP. At the HLE, return an ISO 8208 CALL REQUEST packet to the ADLP with the same SVC number as in the ISO 8208 CALL REQUEST packet originally form the ADLP. At the HLE, verify that a new ISO 8208 CALL REQUEST packet is received form the ADLP with a different SVC. Return an ISO 8208 CALL ACCEPT packet for this SVC to the ADLP. At the GDLP, verify that a Mode S CALL REQUEST packet is received from the ADLP. Return a Mode S CALL ACCEPT packet to the ADLP for transmission to the HLE. Also, verify that a Mode S CALL ACCEPT packet is received form the ADLP. At the HLE, verify that an ISO 8208 CALL ACCEPT packet is received from the ADLP.

Step 13 – Clear Channels

This test uses Transactions 5 and 6. Perform the procedures in paragraphs 2.4.3.1.1, Step 4, to clear the SVCs, used in Step 12.

2.4.5.1.2 Restart Request States

Step 1 – DTE Restart Procedures

This test uses transactions 1, 2, 13 and 14. Perform the procedures is paragraph 2.4.3.1.1 Step 2 to open two SVCs. From the HLE, send an ISO 8208 RESTART REQUEST to the ADLP. At the HLE, verify that an ISO 8208 RESTART CONFIRMATION is received from the ADLP. At the GDLP, verify that the two Mode S CLEAR REQUEST packets are received from the ADLP for both SVCs, then generate two Mode S CLEAR CONFIRMATION packets to the ADLP for those SVCs. Verify that there is no related output to the ADLP/HLE interface

Step 2 – DCE Restart Procedures

This test uses transactions 15 and 16. Send an ISO 8208 RESTART CONFIRMATION packet from the HLE to the ADLP. At the HLE, verify that the ADLP returns an ISO 8208 RESTART REQUEST packet to the HLE with diagnostic code set to 17. Return an ISO 8208 RESTART CONFIRMATION back to the ADLP. Verify that there is no output at the ADLP/GDLP interface.

2.4.5.1.3 Reset States

Step 1 – Reset Procedures by HLE

This test uses transactions 1, 2, 3, 4, 17 and 18. Perform the call setup and data transaction procedures as in paragraph 2.4.3.1.1 Steps 1 and 2. From the HLE, send an ISO 8208 RESET REQUEST packet to the ADLP on the open SVC. At the HLE, verify that an ISO 8208 RESET CONFIRMATION is returned from the ADLP for that SVC. At the GDLP, verify that a Mode S RESET REQUEST is received from the ADLP with the appropriate resetting and diagnostic codes, then uplink a Mode S RESET CONFIRMATION packet back to the ADLP. Verify that there is no other output at the ADLP/HLE interface.

Step 2 – Reset Procedures by HLE. GDLP Responds with a Mode S RESET REQUEST

This test uses transactions 17 and 22. From the HLE, send an ISO 8208 RESET REQUEST to the ADLP on the open SVC. Verify that an ISO 8208 RESET CONFIRMATION is returned to the HLE from the ADLP on that SVC. At the GDLP, verify that a Mode S RESET REQUEST packet is received from the ADLP with the appropriate resetting and diagnostic codes. Also, from the GDLP, send a Mode S RESET REQUEST packet to the ADLP on the open SVC. Verify that there is no related output at the ADLP/HLE interface.

Step 3 – Reset Procedure from GDLP

This test uses transactions 19 and 20. From the GDLP, generate a Mode S RESET REQUEST packet to the ADLP on the open channel. Also, at the GDLP, verify that a Mode S RESET CONFIRMATION is returned from the ADLP on that channel. At the

HLE, verify that an ISO 8208 RESET REQUEST is received from the ADLP with the appropriate resetting and diagnostic codes. From the HLE, return an ISO 8208 RESET CONFIRMATION packet back to the ADLP. Verify that there is no other output at the ADLP/GDLP interface.

Step 4 – Reset Request from GDLP. HLE responds with an ISO 8208 RESET REQUEST

This test uses transactions 19 and 21. From the GDLP, generate a Mode S RESET REQUEST packet to the ADLP on the open channel. Also, at the GDLP, verify that a Mode S RESET CONFIRMATION is returned from the ADLP on that channel. At the HLE, verify that an ISO 8208 RESET REQUEST is received from the ADLP with the appropriate resetting and diagnostic codes. From the HLE, return an ISO 8208 RESET REQUEST to the ADLP. Verify that there is no other output at the ADLP/GDLP interface.

Step 5 – Clear Opened Channel

Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4.

2.4.5.1.4 Flow Control Transfer States

Step 1 – Virtual Call Setup

Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2.

Step 2 – Receive Not Ready Procedure

This test uses Transactions 23 and 24. Send a Mode S frame containing a Mode S RECEIVE NOT READY Packet to the ADLP on the open SVC. Send an ISO 8208 DATA Packet with 32 bits of user data to the ADLP. At the GDLP, verify that there no Mode S DATA is received from the ADLP.

Step 3 – Receive Ready Procedure

This test uses Transaction 25. Send a Mode S frame containing a Mode S RECEIVE READY Packet to the ADLP. At the GDLP test set, verify the receipt of a Mode S DATA packet from the ADLP for correct order and content.

Step 4 – Reject Procedures

This test uses Transaction 26. Send a Mode S frame containing a Mode S DATA Packet with an invalid PS value. At the GDLP, verify the reception of a Mode S REJECT packet from the ADLP.

Step 5 – Clear Opened Channel

Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4.

2.4.5.1.5 Interrupt Transfer States

Step 1 – Virtual Call Setup

Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2.

Step 2 – Interrupt Packet from the HLE

This test uses transactions 27, 28, 29 and 30. From the HLE, send an ISO 8208 DATA packet to the ADLP with M-bit set to one and with 125 bytes of user data. Also, from the HLE, send an ISO 8208 INTERRUPT packet with 32 bytes of user data to the ADLP, then send another ISO 8208 DATA packet with 20 bytes of user data and M-bit set to zero. At the GDLP, verify that the Mode S INTERRUPT packet is not the last packet to be received. Also, verify the Mode S DATA packets and INTERRUPT packet for data content and length. Return a Mode S INTERRUPT CONFIRMATION packet back to the ADLP. At the HLE, verify the receipt of an ISO 8208 INTERRUPT CONFIRMATION packet from the ADLP.

Step 2a – Interrupt Packet from the HLE > 32 bytes

This test uses transaction 28. From the HLE, send an ISO 8208 INTERRUPT packet with 40 bytes of user data to the ADLP. Verify that the ADLP discards this packet (since its data size is greater than 32 bytes) by observing no output at the GDLP.

Step 3 – Interrupt Packet from the GDLP

This test uses transactions 35, 36, 37 and 38. From the GDLP, generate a Mode S DATA packet to the ADLP containing 25 bytes of user data and M-bit set to 1. Also, generate a Mode S INTERRUPT packet to the ADLP with 20 bytes of user data. Then, generate a Mode S DATA packet to the ADLP with 20 bytes of user data and M-bit set to zero. At the HLE, verify the receipt of an ISO 8208 INTERRUPT packet from ADLP before the receipt of the ISO 8208 DATA packet from the ADLP. From the HLE, return an ISO 8208 INTERRUPT CONFIRMATION back to the ADLP. At the GDLP, verify the receipt of a Mode S INTERRUPT CONFIRMATION packet from the ADLP. At the HLE, verify the data content of the INTERRUPT and DATA packets for correctness.

From the GDLP, generate a second Mode S INTERRUPT packet to the ADLP with 20 bytes of user data. Do not allow the HLE test set to return an ISO 8208 INTERRUPT CONFIRMATION back to the ADLP. At the GDLP, generate another Mode S INTERRUPT packet to the ADLP with 20 bytes of user data. Verify that the ADLP generates an ISO 8208 RESET REQUEST to the HLE test set and a Mode S RESET REQUEST back to the GDLP.

Step 4 – Clear Opened Channel

Perform the procedures in paragraph 2.4.3.1.1 Step 4 to cleat the open SVC.

2.4.5.1.6 MSP Operations

Step 1 – Data from HLE

This test uses transaction 31. Send 4 bytes of CONTROL MESSAGE data from the HLE/SI on channel 1. Verify at the GDLP that the ADLP has sent a Mode S short form MSP packet on channel 1.

Step 2 – DATA from HLE

This test uses Transaction 31. Send 42 bytes of CONTROL MESSAGE DATA from the HLE/Sl on channel 1. At the GDLP, verify that two Mode S MSP packets (long form) are received from the ADLP on channel 1.The first frame will have L-bit set to one and contain 26 bytes of user data. The second frame will have L-bit set to zero and contain 16 bytes of user data.

Step 3 – Short MSP from the GDLP

This test uses Transaction 32. Send a Mode S frame containing a Mode S MSP (short form) Packet to the ADLP on channel 2. Fill the UD Field with five bytes of the bit pattern 01010101. At the HLE/SI interface, verify the reception of a CONTROL MESSAGE DATA on channel 2.

Step 4 – Data from the GDLP

Generate 42 bytes of Control Message Data from the GDLP/SI interface on MSP channel 1 in a total of 2 MSP packets (Long Form). The first MSP packet will have L-bit set to 1 and contain 26 bytes of User Data. The second MSP packet will have L-bit set to 0 and contain 16 bytes of User Data. At the HLE/SI interface, verify that an MSP packet (Long Form) is received from the ADLP on channel 1.

2.4.5.2 Error Recovery Procedures

The Error Recovery State Test Procedures are designed to test the capability of the ADLP to recover from erroneous packets received over the ISO 8208 or Mode S interface. A series of ISO 8208 and Mode S packets will be transferred across the ADLP boundaries to stimulate the logical states. The table below shows the required input and output for this test. Entries in the table are denoted either "ISO 8208" or "Mode S." ISO 8208 refers to transactions at the HLE interface, and Mode S refers to transactions at the transponder/GDLP interface. Unless otherwise noted, all tests occur on a single logical channel.

Use the ISO 8208 test set to perform the HLE functions, and use the data generator and network analyzer to perform the transponder/GDLP functions.

The following packet transactions are required for the Error Recovery Test Procedures:

ADLP INPUT	ADLP OUTPUT
1 Invalid ISO 8208 Packet	ISO 8208 CLEAR REQUEST
2 ISO 8208 CLEAR CONF.	None
3 ISO 8208 CALL REQUEST	Mode S CALL REQUEST
4. Invalid ISO 8208 Packet	ISO 8208 CLEAR REQUEST Mode S CLEAR REQUEST
5. Any ISO 8208 Packet except CLEAR REQUEST or CLEAR CONFIRMATION	None
6. Mode S CLEAR CONF.	None
7. Mode S CALL REQUEST	ISO 8208 CALL REQUEST
8. Invalid Mode S Packet	Mode S CLEAR REQUEST ISO 8208 CLEAR REQUEST
9. Mode S CLEAR REQUEST	ISO 8208 CLEAR REQUEST
10. Mode S CLEAR REQUEST	Mode S CLEAR CONF.
11. Invalid Mode S Packet	Mode S CLEAR REQUEST
12. Mode S CALL ACCEPT	ISO 8208 CALL ACCEPT
13. Mode S CLEAR CONF.	Mode S CLEAR REQUEST ISO 8208 CLEAR REQUEST
14. Invalid ISO 8208 Packet	ISO 8208 DIAGNOSTIC
15. ISO 8208 DIAGNOSTIC	None
16. ISO 8208 RESTART CONF.	None
17. ISO 8208 RESTART CONF.	ISO 8208 RESTART REQ
18. Invalid ISO 8208 Packets	None
19. Mode S RESET CONF.	None
20. ISO 8208 RESET CONF.	None
21. Invalid Mode S Packet	None
22. ISO 8208 RESET CONF.	Mode S RESET REQUEST ISO 8208 RESET REQUEST
23. Invalid ISO 8208 Packets	ISO 8208 RESET REQUEST Mode S RESET REQUEST
24. Mode S RESET CONF.	Mode S RESET REQUEST ISO 8208 RESET REQUEST
25. Mode S INTERRUPT	ISO 8208 INTERRUPT
26. Mode S RNR	None
27. Invalid Mode S RR	Mode S RESET REQUEST ISO 8208 RESET REQUEST
28. Invalid Mode S DATA	Mode S RESET REQUEST ISO 8208 RESET REQUEST
29. Invalid Mode S DATA	Mode S REJECT
30. Invalid PS in ISO 8208 DATA	None
31. Invalid ISO 8208 RR	ISO 8208 RESET REQUEST Mode S RESET REQUEST
32. ISO 8208 RNR	None
33. ISO 8208 INTERRUPT	Mode S INTERRUPT
34. ISO 8208 INTERRUPT	ISO 8208 RESET REQUEST Mode S RESET REQUEST
35. Mode S INTERRUPT CONF.	Mode S RESET REQUEST ISO 8208 RESET REQUEST
36. Mode S INTERRUPT	Mode S RESET REQUEST ISO 8208 RESET REQUEST
37. ISO 8208 CALL REQUEST	ISO 8208 RESET REQUEST

38. ISO 8208 INTERRUPT	ISO 8208 INTERRUPT CONF. Mode S INTERRUPT
39. Mode S CALL REQUEST	None
40. Not used	
41. Mode S DATA	Mode S RNR
42. Invalid Mode S Packet	Mode S RESET REQUEST ISO 8208 RESET REQUEST
43. Invalid Mode S DATA	None
44. ISO 8208 RECEIVE READY	ISO 8208 DATA Mode S REJECT
45. Mode S DATA	None
46. ISO 8208 DATA	None
47. Invalid ISO 8208 DATA	None
48. ISO 8208 CLEAR REQUEST	ISO 8208 CLEAR CONF. Mode S CLEAR REQUEST
49. Invalid Mode S RNR	Mode S RESET REQUEST ISO 8208 RESET REQUEST
50. Invalid Mode S REJECT	Mode S RESET REQUEST ISO 8208 RESET REQUEST
51. Invalid ISO 8208 DATA	ISO 8208 RESET REQUEST Mode S RESET REQUEST
52. Invalid ISO 8208 RNR	ISO 8208 RESET REQUEST Mode S RESET REQUEST
53. ISO 8208 INTERRUPT CONF.	ISO 8208 RESET REQUEST Mode S RESET REQUEST

2.4.5.2.1 DCE Call Setup and Clearing States

Step 1 – Ready State (p1)

This test uses Transactions 1 and 2 to verify the DCE p1 State.

a. Send an ISO 8208 CALL ACCEPT to the ADLP. At the HLE, verify that an ISO 8208 CLEAR REQUEST packet is received form the ADLP with diagnostic code set to 20. Return an ISO 8208 CLEAR CONFIRMATION to the ADLP. Verify there is no corresponding output on the Mode S interface.

b. Perform the procedures in Step 1a replacing the ISO 8208 CALL ACCEPT sent to the ADLP with each of the following ISO 8208 packets: RESET REQUEST, CLEAR CONFIRMATION, RESET CONFIRMATION, DATA, INTERRUPT, RECEIVE READY and RECEIVE NOT READY. Verify the results as in Step 1a.

c. Send an ISO 8208 RESTART REQUEST to the ADLP with channel number not equal to zero. At the HLE, verify that an ISO 8208 CLEAR REQUEST packet is received from the ADLP with diagnostic code set to 41. Return an ISO 8208 CLEAR CONFIRMATION to the ADLP. Verify that there is no corresponding output on the Mode S interface.

d. Perform the procedures in Step la, replacing the ISO 8208 CALL ACCEPT sent to the ADLP with an ISO 8208 packet having a packet type identifier shorter than one byte. Verify that the diagnostic code is set to 38 in the ISO 8208 CLEAR REQUEST.

e. Perform the procedures in Step la, replacing the ISO 8208 CALL ACCEPT sent to the ADLP with an ISO 8208 packet having a packet type identifier which is undefined or not supported. Verify that the ADLP returns an ISO 8208 CLEAR REQUEST with diagnostic code set to 33.

Step 2 – DTE Call Request State (p2)

This test uses Transactions 3, 4, 6 and 2 to verify the DCE p2 State.

a. Send an ISO 8208 CALL REQUEST to the ADLP. At the GDLP, verify that a Mode S CALL REQUEST packet from the ADLP is received.

b. Send an ISO 8208 RESET REQUEST on the same SVC to the ADLP. At the HLE, verify than an ISO 8208 CLEAR REQUEST packet is received from the ADLP. At the GDLP, verify that a Mode S CLEAR REQUEST packet is received from the ADLP with diagnostic code set to 21. Return an ISO 8208 CLEAR CONFIRMATION and use the data generator to return a Mode S frame containing a Mode S CLEAR CONFIRMATION to the ADLP.

c. Perform the procedures in Steps 2a and 2b, replacing the ISO 8208 RESET REQUEST sent to the ADLP in procedure 2b with each of the following ISO 8208 packets: CALL REQUEST, CALL ACCEPT, CLEAR CONFIRMATION, DATA, INTERRUPT, RECEIVE READY and RECEIVE NOT READY. Verify the results as in Step 2b.

d. Perform the procedures in Steps 2a and 2b, replacing the ISO 8208 RESET REQUEST sent to the ADLP in procedure 2b with an ISO 8208 packet having a packet type identifier shorter than one byte. Verify that the diagnostic code is set to 38 in the CLEAR REQUESTs.

e. Perform the procedures Steps 2a and 2b, replacing the ISO 8208 RESET REQUEST sent to the ADLP in procedure 2b with an ISO 8208 packet having a packet type identifier which is undefined or not supported. Verify that the diagnostic code is set to 33 in the CLEAR REQUESTs.

f. Perform the procedures in Steps 2a and 2b, replacing the ISO 8208 RESET REQUEST sent to the ADLP in procedure 2b with an ISO 8208 RESTART REQUEST or a RESTART CONFIRMATION with a logical channel number not equal to zero. Verify that the diagnostic code is set to 41 in the CLEAR REQUESTs.

Step 3 – DCE Call Request Slate (p3)

This test uses Transactions 7, 4, 2 and 6 to verify the DCE p3 State.

a. Send a Mode S frame containing a Mode S CALL REQUEST to the ADLP. Verify the ISO 8208 CALL REQUEST.

b. Send an ISO 8208 RESET REQUEST on the same SVC to the ADLP. At the HLE, verify that an ISO 8208 CLEAR REQUEST packet is received from the ADLP. At the GDLP, verify that a Mode S CLEAR REQUEST packet is received from the ADLP with diagnostic code set to 22. Send an ISO 8208 CLEAR CONFIRMATION to the ADLP, and use the data generator to send a Mode S frame containing a Mode S CLEAR CONFIRMATION to the ADLP. Verify that there is no corresponding output at the ISO 8208 and Mode S interfaces.

c. Perform the procedures in Steps 3a and 3b five times. For each iteration replace the ISO 8208 RESET REQUEST sent to the ADLP in Step 3b with one of the following ISO 8208 packets: CLEAR CONFIRMATION, DATA, RECEIVE READY, RECEIVE NOT READY and INTERRUPT. Verify the results as in Step 3b.

d. Perform the procedures in Steps 3a and 3b, replacing the ISO 8208 RESET REQUEST sent to the ADLP in Step 3b with an ISO 8208 packet having a Packet Type Identifier shorter than one byte. Verify that the diagnostic code is set to 38.

e. Perform the procedures in Steps 3a and 3b, replacing the ISO 8208 RESET REQUEST sent to the ADLP in Step 3b with an ISO 8208 packet having a Packet Type Identifier which is undefined or not supported. Verify that the diagnostic code is set to 33.

f. Perform the procedures in Steps 3a and 3b, replacing the ISO 8208 RESET REQUEST sent to the ADLP in Step 3b with an ISO 8208 RESTART REQUEST Packet with the logical channel identifier not equal to zero. Verify that the diagnostic code is set to 41.

<u>Step 4 – Data Transfer State (p4)</u>

This test uses Transactions 3, 12, 4, 2 and 6 to verify the ADCE and DCE p4 State.

a. Perform call setup procedures, paragraph 2.4.3.1.1 Step 2.

b. Send an ISO 8208 CALL REQUEST on the open SVC to the ADLP. At the HLE, verify that an ISO 8208 CLEAR REQUEST packet is received from the ADLP. At the GDLP, verify that a Mode S CLEAR REQUEST packet is received from the ADLP with diagnostic code set to 23.Bit eight of the Clearing Cause Field should be set to zero because the error originated at the DTE/DCE interface. Return an ISO 8208 CLEAR CONFIRMATION, and use the data generator to send a Mode S frame containing a Mode S CLEAR CONFIRMATION to the ADLP. Verify that neither confirmation appears in the other interface.

c. Perform the procedures in Step 4a and Step 4b two times. For the first iteration replace the ISO 8208 CALL REQUEST sent to the ADLP with an ISO 8208 CALL ACCEPT. For the second iteration, replace the ISO 8208 CALL REQUEST sent to the ADLP with an ISO 8208 CLEAR CONFIRMATION. Verify the results as in Step 4b.

<u>Step 5 – Call Collision State (p5)</u>

The error recovery procedures for the Call Collision (p5) State will not be tested.

<u>Step 6 – Clear Request by DTE State </u>(p6)

The error recovery procedures for the Clear Request by DTE (p6) State will not be tested.

<u>Step 7 – DCE Clear to DTE State (p7)</u>

a. Send an ISO 8208 Call Request to the ADLP on SVC 4095. At the GDLP, verify the receipt of a Mode S CALL REQUEST packet from the ADLP.

b. Send another ISO 8208 Call Request on SVC 4095 to stimulate the ADLP into the DCE P7 state. Send the following ISO 82-08 packets and verify that there is no output at the Mode S interface:

ISO 8208 CALL REQUEST.
ISO 8208 CALL ACCEPT.
ISO 8208 RESET REQUEST.
ISO 8208 RESET CONFIRMATION.
ISO 8208 DATA.
ISO 8208 RR.
ISO 8208 RNR.
ISO 8208 INTERRUPT.
ISO 8208 PACKET TYPE ID SHORTER THAN 1 BYTE.
ISO 8208 PACKET WHICH IS UNDEFINED.

c. From the HLE test set, generate an ISO 8208 CLEAR CONFIRMATION packet to the ADLP. From the GDLP test set, generate a Mode S CLEAR CONFIRMATION packet back to the ADLP. These events will allow the ADLP's state machines to return in the ready state (p1).

2.4.5.2.2 ADCE Call Setup and Clearing States

<u>Step 1 – ADCE Ready State (p1)</u>

This test uses Transactions 10, 11 and 6 to verify the ADCE p1 State.

a. Send a Mode S frame containing a Mode S CLEAR REQUEST Packet to the ADLP. At the GDLP, verify the receipt of a Mode S CLEAR CONFIRMATION packet from the ADLP.

b. Send a Mode S frame containing a Mode S CALL ACCEPT Packet to the ADLP. At the GDLP, verify the receipt of a Mode S CLEAR REQUEST packet from the ADLP with diagnostic code set to 20. Return a Mode S frame containing a Mode S CLEAR CONFIRMATION to the ADLP. Verify that there is no corresponding output at the ADLP/HLE interface.

<u>Step 2 – GDLP Call Request State (p2)</u>

This test uses Transactions 7, 8, 6 and 2 to verify the ADCE p2 State.

a. Send a Mode S frame containing a Mode S CALL REQUEST to the ADLP. Verify the corresponding ISO 8208 Call Request.

b. Send a Mode S frame containing a Mode S CLEAR CONFIRMATION on the same SVC to the ADLP. At the HLE, verify that an ISO 8208 CLEAR REQUEST packet is received from the ADLP. At the GDLP, verify that a Mode S CLEAR REQUEST packet is received from the ADLP with diagnostic code set to 21. Bit eight of the Clearing Cause Fields should be set to one, because the error was detected at the Mode S interface. Send an ISO 8208 CLEAR CONFIRMATION and the data generator to return a Mode S frame containing a Mode S CLEAR CONFIRMATION to the ADLP.

c. Perform the procedures in Steps 2a and 2b two times. For the first iteration, replace the Mode S CLEAR CONFIRMATION Packet sent to the ADLP in Step 2 with a Mode S

CALL REQUEST. For the second iteration, replace the CLEAR CONFIRMATION with a Mode S CALL ACCEPT Packet. Verify the results as in Step 2b.

d. Perform the procedures in Steps 2a and 2b six times. For each iteration replace the Mode S CLEAR CONFIRMATION sent to the ADLP in Step 2b with one of the following Mode S Packets: DATA, RESET REQUEST, RECEIVE NOT READY, RECEIVE READY, INTERRUPT. Verify the results as in Step 2b.

Step 3 – ADCE Call Request State (p3)

This test uses Transactions 3, 8, 2 and 6 to verify the ADCE p3 State.

a. Send an ISO 8208 CALL REQUEST to the ADLP. At the GDLP, verify that a Mode S CALL REQUEST packet is received from the ADLP.

b. Send a Mode S frame containing a Mode S CLEAR CONFIRMATION to the ADLP with TC set to 0.. At the HLE, verify that an ISO 8208 CLEAR REQUEST packet is received from the ADLP. At the GDLP, verify that a Mode S CLEAR REQUEST packet is received from the ADLP with diagnostic code set to 22. Bit eight of the Clearing Cause Fields should be set to one, because the error was detected at the Mode S interface. Return an ISO 8208 CLEAR CONFIRMATION, and then return a Mode S frame containing a Mode S CLEAR CONFIRMATION to the ADLP.

c. Perform the procedures in Steps 3a and 3b, replacing the Mode S CLEAR CONFIRMATION sent to the ADLP in Step 3b with each of the following Mode S packets: RECEIVE READY, RECEIVE NOT READY, DATA, INTERRUPT and RESET REQUEST. Verify the results as in Step 3b.

Step 4 – ADCE Data Transfer State (p4)

This test uses Transactions 3, 12, 8, 6 and 2 to verify the ADCE p4 State.

a. Perform call setup procedures, paragraph 2.4.3.1.1 Step 2.

b. Send a Mode S frame containing a Mode S CALL ACCEPT Packet to the ADLP. At the HLE, verify that an ISO 8208 CLEAR REQUEST packet is received from the ADLP. At the GDLP, verify that a Mode S CLEAR REQUEST packet is received for the ADLP with diagnostic code set to 23. The Clearing Cause Fields will have bit 8 set to 1 because the error originated within the Mode S subnetwork. Return an ISO 8208 CLEAR CONFIRMATION and then return a Mode S frame containing a Mode S CLEAR CONFIRMATION to the ADLP.

c. Perform the procedures in Steps 4a and 4b. Replace the Mode S CALL ACCEPT sent to the ADLP in Step 4b with a Mode S CLEAR CONFIRMATION. Verify the results as in Step 4b.

Step 5 – Clear Request By GDLP State (p6)

The error recovery procedures for the Clear Request by GDLP State (p6) will not be tested.

Step 6 – Clear Request by ADCE to GDLP (p7)

This test uses Transactions 3, 12, 13, 21, 2 and 6 to verify the actions of the ADLP while the SVC is in the ADCE p7 State.

a. Perform virtual call setup procedures, paragraph 2.4.3.1.1 Step 2.

b. Send a Mode S frame containing a Mode S CLEAR CONFIRMATION to the ADLP. At the HLE, verify that an ISO 8208 CLEAR REQUEST packet is received from the ADLP with diagnostic code set to 23. At the GDLP, verify that a Mode S CLEAR REQUEST packet is received from the ADLP. Send a Mode S frame containing a Mode S CALL ACCEPT Packet to the ADLP. Verify that there is no corresponding output from this action.

c. Send the following Mode S packets to the ADLP: DATA, RESET, RECEIVE NOT READY, INTERRUPT and RECEIVE READY. Verify that there is no corresponding output from this action.

d. Send a Mode S frame containing a Mode S CLEAR REQUEST to the ADLP. Send an ISO 8208 CLEAR CONFIRMATION to the ADLP.

2.4.5.2.3 DCE Restart States

Step 1 – Packet Level Ready State (r1)

This test uses Transactions 14, 15, 16 and 17 to verify the DCE r1 State.

a. From the HLE, send an ISO 8208 CALL REQUEST packet to the ADLP with SVC number 0. At the HLE, verify that the ADLP has generated an ISO 8208 DIAGNOSTIC packet back to the HLE with diagnostic code set to 36 and the diagnostic cause field containing the first three bytes of the ISO 8208 CALL REQUEST.

b. From the HLE, send an ISO 8208 RESTART REQUEST packet to the ADLP with a format error. At the HLE, verify that the ADLP has returned an ISO 8208 DIAGNOSTIC packet with diagnostic code set to either 38, 39, 81 or 82 and the diagnostic cause field containing the first three bytes of the ISO 8208 RESTART REQUEST.

c. From the HLE, send an ISO 8208 RESTART CONFIRMATION packet to the ADLP. At the HLE, verify that the ADLP has returned an ISO 8208 RESTART REQUEST packet back to the HLE with diagnostic code set to 17.

d. Send an ISO 8208 RESTART CONFIRMATION to the ADLP. The ADLP enters the r1 State.

<u>Step 2 – DTE Restart Request State (r2)</u>

The DTE Restart Request State (r2) error recovery procedures will not be tested.

<u>Step 3 – DCE Restart Request State (r3)</u>

This test uses Transactions 17, 14, 15, 18 and 16 to verify the DCE r3 State.

a. Perform the procedures in Step Id, DCE, enters the r3 State.

b. Perform the procedures in Step lb.

c. Perform the procedures in Step 1a.

d. Perform the procedures in Step Id.

<u>Step 4 – DCE Special Cases</u>

This test uses Transaction 14.

a. From the HLE, send an ISO 8208 packet to the ADLP that is less than two bytes in length. At the HLE, verify that the ADLP returns an ISO 8208 DIAGNOSTIC packet with diagnostic code set to 38.

b. From the HLE, send an ISO 8208 CALL REQUEST packet to the ADLP with an invalid General Format Identifier (GFI). At the HLE, verify that the ADLP returns an ISO 8208 DIAGNOSTIC packet with diagnostic code set to 40.

2.4.5.2.4 DCE Reset States

<u>Step 1 – Erroneous ISO 8208 Packets for the Flow Control Ready State (d1)</u>

This test uses Transactions 3, 12, 23, 19, 20, 48 and 6 to verify the DCE d1 State.

a. Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2.

b. From the HLE, send an ISO 8208 RESTART REQUEST packet to the ADLP with a logical channel identifier unequal to zero on the open SVC. At the HLE, verify that the ADLP sends an ISO 8208 RESET REQUEST packet to the HLE. At the GDLP, verify that a Mode S RESET REQUEST is received from the ADLP on the related SVC with diagnostic code set to 41.

c. From the HLE, send an ISO 8208 RESET CONFIRMATION packet to the ADLP, and from the GDLP, generate a Mode S RESET CONFIRMATION packet to the ADLP.

d. Perform the procedures in Steps lb and 1c. For this iteration, replace the ISO 8208 RESTART REQUEST sent to the ADLP in Step lb with a packet having an invalid Packet Type Identifier shorter than one byte. Verify that the diagnostic codes are set to 38 in the corresponding RESET REQUEST.

e. Perform the procedures in Step lb and Step 1c. For this iteration, replace the ISO 8208 RESTART REQUEST with a packet having a Packet Type Identifier which is undefined. Verify that the diagnostic codes are set to 33 in the corresponding RESET REQUESTs.

f. Perform the Clear Request procedures in paragraph 2.4.3.1.1 Step 4.

Step 2 – Reset Request by DTE (d2)

The DTE Reset Request (d2) State error recovery procedures will not be tested.

Step 3 – Reset Request by DCE to DTE (d3)

This test uses Transactions 3, 12, 22, 18, 19, 20, 48 and 6 to verify the DCE d3 State.

a. Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2.

b. From the HLE, send an ISO 8208 RESET CONFIRMATION packet to the ADLP on the open SVC. At the HLE, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP. At the GDLP, verify that a Mode S RESET REQUEST packet is received from the ADLP with diagnostic code set to 27.

c. From the HLE, send an ISO 8208 INTERRUPT packet to the ADLP. Verify that there is no related output at the ADLP/GDLP interface.

d. Perform the procedures in Step 3c, replacing the ISO 8208 INTERRUPT Packet sent to the ADLP in Step 3c with each of the following ISO 8208 packets: INTERRUPT CONFIRMATION, RESTART REQUEST with channel number unequal to zero, DATA, RECEIVE READY, RECEIVE NOT READY, REJECT, a packet having a Packet Type Identifier shorter than one byte, and a Packet having a Packet Type Identifier which is undefined. Send an ISO 8208 RESET CONFIRMATION and use the data generator to send a Mode S frame containing a Mode S RESET CONFIRMATION to the ADLP. Verify the results as in 3c.

e. Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4.

2.4.5.2.5 ADCE Reset States

Step – 1 ADCE Flow Control Ready State (d1)

This test uses Transactions 3, 12, 24, 19, 20, 48 and 6 to verify the ADCE d1 State.

a. Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2.

b. From the GDLP, send a Mode S RESET CONFIRMATION packet to the ADLP. At the HLE, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP. At the GDLP, verify that the Mode S RESET REQUEST packet is received from the ADLP with diagnostic code set to 27.

c. Return an ISO 8208 RESET CONFIRMATION and then return a Mode S frame containing a Mode S RESET CONFIRMATION to the ADLP.

d. Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4.

<u>Step 2 – Reset Request by GDLP State (d2)</u>

The Reset Request by GDLP State (d2) error recovery procedures will not be tested.

<u>Step 3 – Reset Request by ADCE to GDLP State (d3)</u>

This test uses Transactions 3, 12, 24, 21, 19, 20, 48 and 6 to verify the ADCE d3 State.

a. Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2.

b. From the GDLP, send a Mode S RESET CONFIRMATION packet to the ADLP on the open SVC. At the HLE, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP. At the GDLP, verify that the a Mode S RESET REQUEST packet is received from the ADLP with diagnostic code set to 27.

c. From the GDLP, send a Mode S INTERRUPT packet to the ADLP. Verify that there is no related output at the ADLP/HLE interface.

d. Perform the procedure in Step 3c five times. For each iteration replace the Mode S INTERRUPT Packet sent to the ADLP with one of the following Mode S packets: INTERRUPT CONFIRMATION, DATA, RECEIVE READY, and RECEIVE NOT READY.

e. Perform the procedures in Step 1c.

f. Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4.

2.4.5.2.6 ADCE Flow Control Transfer States

<u>Step 1 – GDLP Receive Not Ready State (g2)</u>

This test uses Transactions 3, 12, 26, 27, 49, 50, 19, 20, 48 and 6 to verify the ADCE g2 State.

a. Perform the virtual call setup procedures in paragraph 2.4.3.1.1 Step 2.

b. Send a Mode S frame containing a Mode S RECEIVE NOT READY Packet to the ADLP.

c. From the GDLP, send a Mode S RECEIVE READY packet to the ADLP with an invalid PR field. At the GDLP, verify that a Mode S RESET REQUEST packet is received from the ADLP, and at the HLE, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP with diagnostic code set to 2.

d. Return an ISO 8208 RESET CONFIRMAT10N and use the data generator to return a Mode S frame containing a Mode S RESET CONFIRMAT10N to the ADLP.

e. Perform the procedures in Steps lb, 1c and 1d two times. For the first iteration replace the Mode S RECEIVE READY Packet sent to the ADLP in Step 1c with a Mode S RECEIVE NOT READY Packet. For the second iteration replace the Mode S RECEIVE READY Packet with a Mode S REJECT Packet. Verify the results as in Step 1c.

f. Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4.

Step 2 – GDLP Receive Ready State (g1)

This test uses Transaction 3, 12, 27, 49, 50, 19, 20, 48 and 6 to verify the ADCE g1 State.

a. Perform the procedures in Steps la, 1c, 1d, le and 1f. When performing the procedures in Step le, do not send the RNR that is called for in Step 1b.

Step 3 – ADCE Receive Not Ready State (f2)

This test uses Transactions 3, 12, 32, 41, 42, 19 and 20 to verify the ADCE f2 State.

a. Perform the call setup procedures as specified in paragraph 2.4.3.1.1 Step 2 to open an SVC.

b. Send an ISO 8208 RECEIVE NOT READY packet to the ADLP via the DTE/DCE interface on the open SVC.

c. Send multiple Mode S DATA packets from the GDLP generator to the ADLP until the ADLP sends a Mode S RECEIVE NOT READY packet back to the GDLP.

d. From the GDLP test set, generate a Mode S DATA packet to the ADLP with an invalid PR field. At the HLE, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP, and at the GDLP, verify that a Mode S CLEAR REQUEST packet is received from the ADLP with diagnostic code set to 2.

e. Verify that the GDLP sends back a Mode S RESET CONFIRMATION back to the ADLP and that the airborne DTE returns back an ISO 8208 RESET CONFIRMATION to the ADLP's DTE/DCE interface.

f. Perform the clear request procedures as specified in paragraph 2.4.3.1.1 Step 4 to clear the open channel.

Step 4 – ADCE Receive Not Ready State (f2). Reject Condition

This test uses Transactions 32, 41, 43 and 44 to verify the ADCE f2 State.

a. Perform the call setup procedures as specified in paragraph 2.4.3.1.1 Step 2 to open an SVC.

b. Send an ISO 8208 RECEIVE NOT READY packet to the ADLP via the DTE/DCE interface on the open SVC.

c. Send multiple of Mode S DATA packets from the GDLP generator to the ADLP until the ADLP sends a Mode S RECEIVE NOT READY packet back to the GDLP.

d. Generate a Mode S DATA packet from the GDLP generator with an invalid PS field to the ADLP.

e. From the HLE test set, generate an ISO 8208 RECEIVE READY packet to the ADLP. At the HLE, verify the receipt of all the ISO 8208 DATA packets previously stored by the ADLP. At the GDLP, verify that a Mode S REJECT packet is received from the ADLP with the expected PS value.

f. Generate a Mode S DATA packet from the GDLP generator with the new PS value to the ADLP.

g. At the HLE test set, verify the receipt of the ISO 8208 DATA packet sent from the ADLP for correctness.

Step 5 – ADCE Receive Not Ready State (f2). Valid DATA Packet received

This test uses Transactions 32, 41, 45, 44, 48 and 6 to verify the ADCE f2 State.

a. Perform the procedures in Steps 3b and 3c.

b. From the GDLP, send a Mode S DATA packet to the ADLP. Verify that there is no related output at the ADLP/HLE.

c. Perform the procedures in Step 4c.

d. Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4.

Step 6 – ADCE Receive Ready State (f1)

This test uses Transactions 3, 12, 29, 28, 48, 19, 20, 48 and 6 to verify the ADCE f1 State.

a. Perform the call setup procedures as specified in paragraph 2.4.3.1.1 Step 2 to open an SVC.

b. From the GDLP test set, generate a Mode S DATA packet to the ADLP with an invalid PR field. At the HLE, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP, and at the GDLP, verify that a Mode S CLEAR REQUEST packet is received from the ADLP with diagnostic code set to 2.

c. Verify that the GDLP sends back a Mode S RESET CONFIRMATION back to the ADLP and that the airborne DTE returns back an ISO 8208 RESET CONFIRMATION to the ADLP's DTE/DCE interface.

Step 7 – ADCE Receive Ready State (f1), Reject Condition

With a channel open still from the previous test:

a. Generate a Mode S DATA packet from the GDLP generator with an invalid PS field to the ADLP.

b. At the HLE, verify that no related output is received. At the GDLP, verify that the ADLP has generated a Mode S REJECT packet with the expected PS value.

c. Generate a Mode S DATA packet from the GDLP generator with the new PS value to the ADLP.

d. At the HLE test set, verify the receipt of the ISO 8208 DATA packet sent from the ADLP for correctness.

e. Perform the clear request procedures as specified in paragraph 2.4.3.1.1 Step 4 to clear the open channel.

<u>Step 8 – ADCE Receive Not Ready State (f2) for LV errors</u>

a. Perform the call setup procedures as specified in paragraph 2.4.3.1.1 Step 2 to open an SVC.

b. From the HLE test set, generate an ISO 8208 RECEIVE NOT READY packet to the ADLP on the open SVC.

c. From the GDLP test set, send multiple Mode S DATA packets to the ADLP until a Mode S RECEIVE NOT READY packet is received from the ADLP.

d. From the GDLP test set, generate a Mode S DATA packet with an incorrect LV field value to the ADLP.

e. At the HLE test, send an ISO 8208 RECEIVE READY packet to the ADLP, then verify that all ISO 8208 DATA packets previously being stored at the ADLP are received at the HLE test set. Verify that the last Mode S DATA packet generated from the GDLP test set is not received by the HLE test as an ISO 8208 DATA packet, since this packet will be rejected by the ADLP state machine due to the incorrect LV field value.

f. At the GDLP test set, verify the receipt of the Mode S REJECT packet from the ADLP with the PS value set to the next expected packet number. Then, generate a Mode S DATA packet back to the ADLP with the PS value set to the next expected packet number and the LV field value set correctly.

g. At the HLE test set, verify the receipt of an ISO 8208 DATA packet from the ADLP.

h. Perform the clear request procedures as specified in paragraph 2.4.3.1.1 Step 4 to clear the open channel.

<u>Step 9 – ADCE Receive Ready State (f1) for LV errors</u>

a. Perform the call setup procedures as specified in paragraph 2.4.3.1.1 Step 2 to open an SVC.

b. From the GDLP test set, generate a Mode S DATA packet with an incorrect LV field value to the ADLP.

c. At the HLE test, verify that there is no related output for this transaction, since this packet will be rejected by the ADLP state machine due to the incorrect LV field value.

d. At the GDLP test set, verify the receipt of the Mode S REJECT packet from the ADLP with the PS value set to the next expected packet number. Then, generate a Mode S DATA packet back to the ADLP with the PS value set to the next expected packet number and the LV field value set correctly.

e. At the HLE test set, verify the receipt of an ISO 8208 DATA packet from the ADLP.

f. Perform the clear request procedures as specified in paragraph 2.4.3.1.1 Step 4 to clear the open channel.

2.4.5.2.7 DCE Flow Control Transfer States

Step 1 – DCE Receive Ready State (f1)

This test uses Transactions 3, 12, 30, 51, 19, 20, 48 and 6 to verify the DCE f1 State.

a. Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2.

b. From the HLE, send an ISO 8208 DATA packet to the ADLP with an invalid PS field. At the HLE, verify the receipt of an ISO 8208 RESET REQUEST packet from the ADLP. At the GDLP, verify that a Mode S RESET REQUEST packet is received from the ADLP with diagnostic code set to 1. From the HLE, return an ISO 8208 RESET CONFIRMATION packet to the ADLP, and from the GDLP, return a Mode S RESET CONFIRMATION packet back to the ADLP.

c. From the HLE, send an ISO 8208 DATA packet to the ADLP with an invalid PR field. At the HLE, verify the receipt of an ISO 8208 RESET REQUEST packet from the ADLP. At the GDLP, verify that a Mode S RESET REQUEST packet is received from the ADLP with diagnostic code set to 2.

d. Perform the reset confirmation procedures in paragraph 2.4.5.2.6 Step 1d.

e. Perform the procedures in Steps 1c and 1d. Replace the ISO 8208 DATA Packet sent to the ADLP in Step 1c with an ISO 8208 DATA Packet less than three bytes in length. Verify that the diagnostic codes are equal to 38.

f. Perform the procedures in Steps 1c and lb. Replace the ISO 8208 DATA Packet sent to the ADLP in Step 1c with an ISO 8208 DATA Packet that has M-bit set to one and a partially full UD Field. Verify that the diagnostic codes are equal to 165.

g. Generate an ISO 8208 CALL REQUEST packet from the airborne DTE with the user data size negotiation facility set to 128 octets. Generate a CALL ACCEPT packet from the GDLP generator to open an SVC and forward the related ISO 8208 CALL ACCEPT packet to the airborne DTE with the acceptance of the negotiated user data size.

h. From the HLE test set, generate an ISO 8208 DATA packet to the ADLP with a user data size greater than the maximum negotiated data size at call setup time. At the HLE, verify that the ADLP has sent an ISO 8208 RESET REQUEST packet, and at the GDLP test set, verify that a Mode S RESET REQUEST packet is received from the ADLP with diagnostic code set to 39. Return an ISO 8208 RESET CONFIRMATION packet from the HLE test set back to the ADLP. Likewise, return a Mode S RESET CONFIRMATION from the GDLP test set back to the ADLP.

i. Perform the clear request procedures as specified in paragraph 2.4.3.1.1 Step 4 to clear the open channel.

Step 2 – DCE Receive Not Ready (f2)

This test uses Transactions 3, 12, 26, 46, 47, 23, 19, 20, 48 and 6 to verify the DCE f2 State.

a. Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2.

b. Send a Mode S frame containing a Mode S RECEIVE NOT READY Packet.

c. Send an ISO 8208 DATA Packets to the ADLP until the ADLP returns an ISO 8208 RECEIVE NOT READY Packet to the HLE.

d. At the GDLP, verify that no Mode S DATA packets are received since they were discarded in the ADLP due to their criteria.

e. Perform the procedures in Step 1c Verify the results.

f. Perform the reset confirmation procedures in paragraph 2.4.5.2.6 Step 1d.

g. Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4.

Step 3 – DTE Receive Ready (g1)

This test uses Transactions 3, 12, 31, 52, 19, 20, 48 and 6 to verify the DTE g1 State.

a. Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2.

b. At the HLE, generate an ISO 8208 RECEIVE READY packet to the ADLP with an invalid PR field. At the HLE, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP. At the GDLP, verify that a Mode S RESET REQUEST packet is received from the ADLP with diagnostic code set to 2.

c. Perform the reset confirmation procedures in paragraph 2.4.5.2.6 Step 1d.

d. Perform the procedures in Step 3b and Step 3c two times. For the first iteration, replace the ISO 8208 RECEIVE READY sent to the ADLP in Step 3b with an ISO 8208 RECEIVE NOT READY. For the second iteration, replace the ISO 8208 RECEIVE READY Packet sent to the ADLP in Step 3b with an ISO 8208 REJECT Packet. Verify the results as in 3b.

e. At the HLE, generate an ISO 8208 flow control (RECEIVE READY, RECEIVE NOT READY or REJECT) packet to the ADLP that is less than 3 bytes in length. Verify that there is no related output at the ADLP/GDLP interface.

f. Perform the Clear Request procedures in paragraph 2.4.3.1.1 Step 4.

Step 4 – DTE Receive Not Ready (g2)

This test uses Transactions 3, 12, 32, 31, 48 and 6 to verify the DTE g2 State.

a. Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2.

b. Send an ISO 8208 RECEIVE NOT READY to the ADLP.

c. Perform the procedures in Steps 3b, 3c, 4b and 3d.

d. Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4.

2.4.5.2.8 DCE Interrupt Transfer States

<u>Step 1 – DTE Interrupt Sent State (j2)</u>

This test uses Transactions 3, 12, 33, 34, 19, 20, 48 and 6 to verify the DCE i2 State.

a. Perform the call setup procedures in paragraph 2.4.3.1.1 Step 2.

b. At the HLE, generate an ISO 8208 INTERRUPT packet to the ADLP. At the GDLP, verify that a Mode S INTERRUPT packet is received from the ADLP. Then, at the HLE, generate another ISO 8208 INTERRUPT packet to the ADLP for the same SVC.

c. At the GDLP, verify that a Mode S RESET REQUEST packet is received from the ADLP. Also, at the HLE, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP with diagnostic code set to 44.

d. Perform the reset confirmation procedures in paragraph 2.4.5.2.6 Step Id.

e. Perform the procedures in paragraph 2.4.3.1.1 Step 4 to clear an open SVC.

<u>Step 2 – DCE Interrupt Ready State </u>(j1)

This test uses Transactions 3, 12, 53, 19, 20, 48 and 6 to verify the DCE j1 State.

a. Perform the procedures in paragraph 2.4.3.1.1 Step 2 to open an SVC.

b. Send an ISO 8208 INTERRUPT CONFIRMATION Packet to the ADLP.

c. At the GDLP, verify that a Mode S RESET REQUEST packet is received from the ADLP. Also, at the HLE, verify that an ISO 8208 packet is received from the ADLP with diagnostic code set to 43.

d. Perform the reset confirmation procedures in paragraph 2.4.5.2.6 Step Id.

e. Perform the procedures in paragraph 2.4.3.1.1 Step 4 to clear an SVC.

2.4.5.2.9 ADCE Interrupt Transfer States

Step 1 – ADCE Interrupt Ready State (j1)

This test uses Transactions 3, 12, 35, 19, 20, 48 and 6 to verify the ADCE j1 State.

a. Perform the procedures in paragraph 2.4.3.1.1 Step 2 to open an SVC.

b. From the GDLP, generate a Mode S INTERRUPT CONFIRMATION packet to the ADLP. At the HLE, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP, and at the GDLP, verify that a Mode S RESET REQUEST packet is received from the ADLP with diagnostic code set to 43.

c. Perform the reset confirmation procedures in paragraph 2.4.5.2.6 Step Id.

d. Perform the procedures in paragraph 2.4.3.1.1 Step 4 to clear an SVC.

Step 2 – GDLP Interrupt Sent State (i2)

This test uses Transactions 3, 12, 25, 36, 19, 20, 48 and 6 to verify the ADCE i2 State.

a. Perform the procedures in paragraph 2.4.3. 1.1 Step 2 to open an SVC.

b. From the GDLP, generate a Mode S INTERRUPT packet to the ADLP. At the HLE, verify that an ISO 8208 INTERRUPT packet is received from the ADLP.

c. Send Mode S frame containing another Mode S INTERRUPT Packet to the ADLP.

d. Perform the procedures in paragraph 2.4.5.2.8 Step 1c

e. Perform the procedures in paragraph 2.4.5.2.6 Step 1d.

f. Perform the procedures in paragraph 2.4.3.1.1 Step 4 to clear the SVC.

2.4.5.2.10 ADCE Restart State (r1)

Step 1 – Packet Level Ready State (r1)

a. From the GDLP test set, send a Mode S CALL REQUEST packet to the ADLP with the CH field set to 0 and the TC field set to 0. Verify that the ADLP discards this packet by observing no output at the HLE test set.

b. From the GDLP test set, send a Mode S CALL ACCEPT packet to the ADLP with the CH field set to 0. Verify that the ADLP discards this packet by observing no output at the HLE test set.

c. From the GDLP test set, send an unassigned Mode S packet header to the ADLP. Verify that the ADLP discards this packet by observing no output at the HLE test set.

2.4.5.3 Mode S Subnetwork Error Processing for ISO 8208 packets

These tests are designed to verify the ADLP's ability to perform error processing functions due to erroneous ISO 8208 packet contents.

D-bit in packet.

Perform the Call Setup procedures as specified in paragraph 2.4.3.1.1 Step 2 to open an SVC.

From the HLE test set, generate an ISO 8208 DATA packet with D-bit set to 1. At the HLE test set, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP with cause code set to 133, and diagnostic code set to 166. Respond with an ISO 8208 RESET CONFIRMATION to the ADLP. Verify that there is no related output to the GDLP test set.

Q-bit in packet.

With the SVC still open from the previous test, generate an ISO 8208 DATA packet (from the HLE test set) with Q-bit set to 1 to the ADLP. At the HLE test set, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP with cause code set to 133, and diagnostic code set to 83. Respond with an ISO 8208 RESET CONFIRMATION to the ADLP. Verify that there is no related output to the GDLP test set.

Perform the Clear Request procedures as specified in paragraph 2.4.3.1.1 Step 4 for the open SVC.

Invalid Priority.

From the HLE test set, generate an ISO 8208 CALL REQUEST packet with the priority facility present to the ADLP. Set the priority value to be between 2 and 254 inclusive. At the HLE test set, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP with cause code set to 131, and diagnostic code set to 66. Respond with an ISO 8208 RESET CONFIRMATION to the ADLP. Verify that there is no related output to the GDLP test set.

Unsupported Facility.

From the HLE test set, generate an ISO 8208 CALL REQUEST packet with a facility which is not supported by the ADLP. At the HLE test set, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP with cause code set to 131, and diagnostic code set to 65. Respond with an ISO 8208 RESET CONFIRMATION to the ADLP. Verify that there is no related output to the GDLP test set.

Illegal Calling DTE Address.

From the HLE test set, generate an ISO 8208 CALL REQUEST packet using an invalid calling DTE address to the ADLP. At the HLE test set, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP with cause code set to 141, and diagnostic code set to 68. Respond with an ISO 8208 RESET CONFIRMATION to the ADLP. Verify that there is no related output to the GDLP test set.

Illegal Called DTE Address.

From the HLE test set, generate an ISO 8208 CALL REQUEST packet using an invalid called DTE address to the ADLP. At the HLE test set, verify that an ISO 8208 RESET REQUEST packet is received from the ADLP with cause code set to 141, and diagnostic code set to 67. Respond with an ISO 8208 RESET CONFIRMATION to the ADLP. Verify that there is no related output to the GDLP test set.

2.4.5.4 SVC Flow Control Test

(Paragraph 2.2.4.2.4 – SVC Flow Control)

This test is designed to test the ADLP's ability to maintain flow control.

Perform the call setup procedures as specified in paragraph 2.4.3.1.1 Step 2. From the GDLP, uplink 15 Mode S DATA packets to the ADLP on the open SVC. At the HLE, verify the resultant ISO 8208 DATA packets as well as the sending of the ISO 8208 RECEIVE READY packets back to the ADLP in order to maintain flow control with the ADLP. At the GDLP, verify that the ADLP has sent a Mode S RECEIVE READY packet after not more than 8 DATA packets originally sent by the GDLP. Verify that the Mode S RECEIVE READY packet will contain the PR field of 8.

Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4.

2.4.6 Packet Assembly

The Packet assembly test procedures are designed to test the ADLP's ability to assemble and disassemble ISO 8208 packets and Mode S frames. Unless otherwise indicated, the standard ISO 8208 default parameters apply. The tests are divided into three subgroups, M-bit, S-bit and L-bit linking. Throughout these tests it is assumed that the transponder has no downlink ELM capability. Provide indication to the ADLP to this effect.

2.4.6.1 M-bit Linking

The M-bit linking test procedures are designed to verify the ADLP's ability to combine UD fields of packets to form a larger Packet and also to determine how the UD Field of a Packet can be subdivided to form smaller packets. The table below lists the required input and output for this test. Entries are denoted either "ISO 8208" or "Mode S." ISO 8208 refers to transactions at the HLE interface, and Mode S refers to transactions at the transponder/GDLP interface.

Use the ISO 8208 test set to perform the HLE functions, and use the data generator and network analyzer to perform the transponder/GDLP functions.

The following transactions are required in this test:

ADL Input	ADL Output
1. ISO 8208 CALL REQUEST	Mode S CALL REQUEST
2. Mode S CALL ACCEPT	ISO 8208 CALL ACCEPT
3. ISO 8208 DATA	Mode S DATA
4. Mode S DATA	ISO 8208 DATA
5. ISO 8208 CLEAR REQUEST	ISO 8208 CLEAR CONF.
6. Mode S CLEAR CONF.	Mode S CLEAR REQUEST

Step 1 – Virtual Call Setup

This test uses Transactions 1 and 2 to open multiple SVCs with the ADLP.

a. From the HLE, generate four ISO 8208 CALL REQUEST packets to the ADLP with the following channel numbers: 316, 317, 318 and 319. At the GDLP, verify that four Mode S CALL REQUEST packets are received from the ADLP containing Mode S channel numbers: 15, 14, 13, and 12.

b. From the GDLP, generate four Mode S CALL ACCEPT packets to the ADLP on the related Mode S channel numbers. At the HLE, verify that four ISO 8208 CALL ACCEPT packets are received from the ADLP with the following ISO 8208 channel numbers: 316, 317, 318 and 319.

Step 2 – M-bit Linking Mode S DATA Packets from ISO 8208 Data Packets

This test uses Transaction 3 to verify Mode S Packet assemble procedures in the ADLP.

a. From the HLE, send an ISO 8208 DATA packet to the ADLP on each of the open SVCs. Fill the User Data field for each SVC with 125 bytes of user data with the following patterns:

channel 316	01010101
channel 317	10101010
channel 318	11001100
channel 319	00110011

b. At the GDLP, verify that six Mode S DATA packets are received from the ADLP for each Mode S SVC. Verify that each of the first five Mode S DATA packets contains 24 bytes of the related User Data and has M-bit set to one. Also, verify that the sixth Mode S DATA packet for each Mode S SVC contains the last 8 bytes of the related User Data and has M-bit set to zero. The related User Data content should be as follows:

channel 15	01010101
channel 14	10101010
channel 13	11001100
channel 12	00110011

Step 3 – DATA Packets from the GDLE

This test uses Transaction 4 to verify ISO 8208 Packet assembly procedures in the ADLP.

a. From the GDLP, send six Mode S DATA packets to the ADLP on each of the open SVCs. Set M-bit to one for the first five Mode S DATA packets for each SVC and M-bit to zero for the last Mode S DATA packet on each SVC. Fill the User Data field with 25 bytes of User Data with the following patterns:

channel 15	01010101
channel 14	10101010
channel 13	11001100
channel 12	00110011

b. At the HLE, verify that two ISO 8208 DATA packets are received from the ADLP on each of the open SVC. Verify for each SVC, M-bit is set to one for the first ISO 8208 DATA packet and contains 125 of User Data with the related patterns:

channel 316	01010101
channel 317	10101010
channel 318	11001100
channel 319	00110011

Also, verify that the second ISO 8208 DATA packets has M-bit set to zero for each SVC and contains 25 bytes of User Data with the related patterns as in the above Step 4 – Clear Channels.

This test uses Transactions 5 and 6 to clear the open SVCs. Perform the procedures in paragraph 2.4.3.1.1 Step 4 to clear the four open SVCs.

2.4.6.2 S-bit Linking

Step 1 – ISO 8208 CALL REQUEST with Fast Select

Generate an ISO 8208 CALL REQUEST packet with the Fast Select option with no restriction on the response to the ADLP. Fill the User Data Field with 128 bytes of data. At the GDLP test set, verify the receipt of the Mode S CALL REQUEST packets from the ADLP with the following information:

Packet 1) S-bit = 1, F-bit = 0, Data = 23 bytes, header = 5 bytes.

Packet 2) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 3) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 4) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 5) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 6) S-bit = 0, F-bit = 1, Data = 13 bytes, header = 5 bytes.

Verify the data for correct order and content.

Step 2 – Mode S CALL ACCEPT with Fast Select

Use the GDLP data generator to uplink six linked Mode S CALL ACCEPT packets to the ADLP with the following information:

Packet 1) S-bit = 1, F-bit = 0, Data = 23 bytes, header = 5 bytes.

Packet 2) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 3) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 4) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 5) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 6) S-bit = 0, F-bit = 1, Data = 13 bytes, header = 5 bytes.

At the HLE test set, verify that an ISO 8208 CALL ACCEPT packet is received from the ADLP with fast select option with no restriction on the response, and verify that the user data field contains contain the data originally generated from the GDLP test set in its linked Mode S CALL ACCEPT packets. Verify this data for correct order and content.

Step 3 – ISO 8208 CLEAR REQUEST with Fast Select

Generate an ISO 8208 CLEAR REQUEST packet to the ADLP. Fill the User Data Field with 128 bytes of data. At the GDLP test set, verify the receipt of the Mode S CALL REQUEST packets from the ADLP with the following information:

Packet 1) S-bit = 1, F-bit = 0, Data = 21 bytes, header = 7 bytes.

Packet 2) S-bit = 1, F-bit = 1, Data = 21 bytes, header = 7 bytes.

Packet 3) S-bit = 1, F-bit = 1, Data = 21 bytes, header = 7 bytes.

Packet 4) S-bit = 1, F-bit = 1, Data = 21 bytes, header = 7 bytes.

Packet 5) S-bit = 1, F-bit = 1, Data = 21 bytes, header = 7 bytes.

Packet 6) S-bit = 1, F-bit = 1, Data = 21 bytes, header = 7 bytes.

Packet 7) S-bit = 0, F-bit = 1, Data = 2 bytes, header = 7 bytes.

Verify that the data content of these packets is correct and in order. At the HLE test set, verify that an ISO 8208 CLEAR CONFIRMATION packet is received from the ADLP. Allow the GDLP to return a Mode S CLEAR CONFIRMATION back to the ADLP.

Step 4 – Mode S CALL REQUEST with Fast Select

Use the GDLP data generator to uplink six linked Mode S CALL REQUEST packets to the ADLP with the Fast Select option and with no restriction on the response. Fill the packets with the following information:

Packet 1) S-bit = 1, F-bit = 0, Data = 23 bytes, header = 5 bytes.

Packet 2) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 3) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 4) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 5) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 6) S-bit = 0, F-bit = 1, Data = 13 bytes, header = 5 bytes.

At the HLE test set, verify that an ISO 8208 CALL REQUEST packet is received from the ADLP with fast select option with no restriction on the response, and verify that the user data field contains the data originally generated from the GDLP test set in its linked Mode S CALL REQUEST packets. Verify this data for correct order and content.

Step 5 – ISO 8208 CALL ACCEPT with Fast Select

Return an ISO 8208 CALL ACCEPT packet to the ADLP. Fill the User Data Field with 128 bytes of data. At the GDLP test set, verify the receipt of the Mode S CALL ACCEPT packets from the ADLP with the following information:

Packet 1) S-bit = 1, F-bit = 0, Data = 23 bytes, header = 5 bytes.

Packet 2) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 3) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 4) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 5) S-bit = 1, F-bit = 1, Data = 23 bytes, header = 5 bytes.

Packet 6) S-bit = 0, F-bit = 1, Data = 13 bytes, header = 5 bytes.

Verify that the data content of these packets is correct and in order.

Step 6 – Mode S CLEAR REQUEST with Fast Select

Use the GDLP data generator to uplink seven linked Mode S CLEAR REQUEST packets to the ADLP with the following information:

Packet 1) S-bit = 1, F-bit = 0, Data = 21 bytes, header = 7 bytes.

Packet 2) S-bit = 1, F-bit = 1, Data = 21 bytes, header = 7 bytes.

Packet 3) S-bit = 1, F-bit = 1, Data = 21 bytes, header = 7 bytes.

Packet 4) S-bit = 1, F-bit = 1, Data = 21 bytes, header = 7 bytes.

Packet 5) S-bit = 1, F-bit = 1, Data = 21 bytes, header = 7 bytes.

Packet 6) S-bit = 1, F-bit = 1, Data = 21 bytes, header = 7 bytes.

Packet 7) S-bit = 0, F-bit = 1, Data = 2 bytes, header = 7 bytes.

At the GDLP test set, verify that a Mode S CLEAR CONFIRMATION packet is received from the ADLP. Also, at the HLE test set, verify that an ISO 8208 CLEAR REQUEST packet is received from the ADLP. Return an ISO 8208 CLEAR CONFIRMATION packet back to the ADLP.

2.4.6.3 L-bit Linking

The Long Form MSP Packet test procedures are designed to test the ADLP's ability to link Mode S Long Form MSP Packets when the packet size is greater than 28 bytes and the transponder has no downlink ELM capability.

The following packet transactions are used in this test:

ADLP Input	ADLP Output
1. CONTROL MESSAGE DATA	Mode S Long Form MSP

This test uses Transaction 1.

a. Use a selected MSP number, fill the Used Data Field with 32 bytes of the bit pattern 01010101. At the GDLP/SI, verify that two mode S long form MSP packets are received on the selected MSP channel from the ADLP. The first frame will have L-bit set to one and contain 26 bytes of user data. The second frame will have L-bit set to zero and contain 6 bytes of user data.

b. Send two Mode S Comm-A frames containing a linked Mode S Long Form MSP Packet to the ADLP on a MSP channel number. Fill the UD Field with 26 bytes and 6 bytes respectively with the bit pattern 10101010. At the HLE/SI interface, verify that a Mode S long form MSP packet is received from the ADLP Verify the UD Field for content and order.

2.4.6.4 Priority Facility

From the HLE test set, generate 3 ISO 8208 CALL REQUEST packets (SVCs 4095, 4094 and 4093) to the ADLP with the priority facility field settings as follows: The packet for SVC 4095 will have its priority set to 0. The packet for SVC 4094 will have its priority set to 0 and the packet for SVC 4093 will have its priority set to 1.

From the GDLP test set, respond with the appropriate Mode S CALL ACCEPT packets to the ADLP to be forwarded to the HLE test set as ISO 8208 CALL ACCEPT packets for those SVCs.

Note: *Send all ISO 8208 DATA packets within the closeout message cancellation time period of the ADLP's frame processor.*

At the HLE test, generate an ISO 8208 DATA packet to the ADLP on SVC 4095 with 10 bytes of user data filled with FF(hex). Do not allow a closeout to be generated from the RF test set for this downlink. Then, send two more ISO 8208 DATA packets to the ADLP, one on SVC 4094 containing 10 bytes of user data filled with FE(hex) and one on SVC 4093 containing 10 bytes of user data filled with FD(hex).

Now, from the RF test set, generate the closeout for the first downlink (containing the data for FF[hex]) and the additional closeouts for the remainder of the downlinks. At the GDLP test set, verify that 3 Mode S DATA packets were received from the ADLP in the following order:

1) The DATA packet which contains the data content of all FF(hex) will be received first, since this was the packet sent when there was no closeout originally. This message was already in the transponder so it did not have to change prioritization.

2) The DATA packet which contains the data content of all FD(hex) will be received second since this DATA was delivered over the high priority SVC (4093) and jumped the queue in the ADLP’s frame processor when messages were being held to the non closeout.

3) The DATA packet which contains the data content of all FE(hex) will be received last since this DATA was delivered over the low priority SVC (4094).

2.4.6.5 Called/Calling Address Extention Facility

This test validates the ability of the ADLP to accept the Address Extention facility of ISO 8208.

From the HLE test set, generate an ISO 8208 CALL REQUEST packet using SVC 4095 and with the Called/Calling Address Extension facility set. This facility enables the XDLP to support different addressing schemes in the event that, the network addressing between a GDLP and ground DTEs (an ATN router or stand alone DTE) does not support the Mode S address.

Verify that the ADLP accepts this facility type and forwards the ISO 8208 CALL REQUEST packet to the reformatting process.

At the GDLP test set, respond by with a Mode S CALL ACCEPT packet.

Verify the ADLP reformatting process generates an ISO 8208 CALL ACCEPT packet on SVC 4095 (with the Address Extention Facility set) to the HLE test set.

2.4.7 Multiple Channel Transactions

The Multiple Channel Transactions test procedures are designed to test the ADLP's ability to process a transaction on one SVC while not affecting the operation of the other open SVCs. The tests are divided into two subgroups: Single HLE and GDLP, and Single HLE and Multiple GDLPs.

Throughout these tests, it is assumed that the transponder has no downlink ELM capability. Provide indication to the ADLP to this effect.

2.4.7.1 Single HLE and GDLP

The Single HLE and GDLP test procedures are designed to test the ADLP's ability to process packets for multiple SVCs when connected to a single HLE and GDLP. Before executing this test, clear the ADLP by cycling power (power off at least 10 seconds). The ADLP will send out a SEARCH request in a broadcast mode. Return a Mode S frame containing a Mode S ROUTE Packet, causing the ADLP to initialize the II Code/DTE cross reference table.

The following packet transactions are required in this test:

ADLP Input	ADLP Output
1. ISO 8208 CALL REQUEST	Mode S CALL REQUEST
2. Mode S CALL ACCEPT	ISO 8208 CALL ACCEPT
3. ISO 8208 DATA	Mode S DATA
4. None	ISO 8208 RECEIVE READY
5. ISO 8208 CLEAR REQUEST	ISO 8208 CLEAR CONF. Mode S CLEAR REQUEST
6. Mode S CLEAR CONF.	None
7. ISO 8208 RESET REQUEST	Mode S RESET REQUEST ISO 8208 RESET CONF.
8. Mode S RESET CONF.	None
9. Mode S DATA	ISO 8208 DATA
10. ISO 8208 RECEIVE READY	None
11. Mode S RECEIVE READY	None
12. ISO 8208 CALL REQUEST	ISO 8208 CLEAR REQUEST Mode S CLEAR REQUEST
13. ISO 8208 CLEAR CONF.	None

2.4.7.1.1 Call Request Procedures

This test uses transactions 1 and 2 to open multiple channels with the ADLP. Perform the call setup procedures as specified in paragraph 2.4.3.1.1 Step 2 fifteen times using the following ISO 8208 SVCs: 316 through 330 (inclusive).

2.4.7.1.2 Data Transmission Procedures

This test uses transactions 3 and 4 to allow for the generation of DATA from the HLE. Perform the data transmission procedures as specified in paragraph 2.4.3.1.1 Step 3 for each of the open SVC.

2.4.7.1.3 Clear Request Procedures

This test uses transactions 5 and 6 to clear opened SVCs. Perform the clear request procedures as specified in paragraph 2.4.3.1.1 Step 4 for channels 318 and 323. Perform the data transmission procedures as specified in paragraph 2.4.7.1.2 for the remaining 13 SVCs. At the GDLP, verify that the clearing procedures did not affect the operation of the ADLP by confirming that the appropriate Mode S DATA packets are received from the ADLP on the remaining opened SVCs.

2.4.7.1.4 Reset Request Procedures

This test uses transactions 7 and 8 to reset opened SVCs. From the HLE, generate ISO 8208 RESET REQUEST packets to the ADLP on SVCs 317, 321 and 326. At the GDLP, verify the Mode S CLEAR REQUEST packets from the ADLP for the related Mode S opened channels. From the GDLP, generate the corresponding Mode S RESET CONFIRMATION packets back to the ADLP for those channels. At the HLE, verify that the ADLP has sent the ISO 8208 RESET CONFIRMATION packets for SVCs 317, 321 and 326. Now, perform the data transmission procedures as specified in paragraph 2.4.7.1.2. At the GDLP, verify that the resetting procedures did not affect the operations of the ADLP by confirming that the Mode S DATA packets have been received with the correct data content for the appropriate SVCs.

2.4.7.1.5 Receive Not Ready Status

<u>Step 1 – Data Transfer</u>

This test uses Transactions 9 and 10 to transfer data from the GDLP.

a. Send two Mode S frames containing two 25-byte Mode S DATA Packets for each open SVC to the ADLP. Set M-bit to zero in both packets. Verify the corresponding ISO 8208 packets.

b. Return ISO 8208 RECEIVE READY Packets for all open SVCs except 316, 322, 327 and 328.

c. Perform the procedures in Step la for the following Mode S channels: 14, 12, 11, 10, 7, 6 and 5. Verify that the receive not ready conditions on channels 316, 322, 327 and 328 do not affect the operations of the other SVCs by confirming at the HLE that the ADLP has forwarded the corresponding ISO 8208 DATA packets to the HLE.

<u>Step 2 – Clear Request Procedures</u>

This test uses Transactions 5 and 6 to clear an SVC. Perform the clear request procedures in paragraph 2.4.3.1.1 for channels 316, 322, 327 and 328. Verify the results.

2.4.7.1.6 Error Recovery Procedures

<u>Step 1 – Force an Error Condition</u>

This test uses Transactions 12, 6, 13, 3 and 4 to force SVCs into an error recovery state.

a. From the HLE, generate ISO 8208 CALL REQUEST packets for SVCs 317 and 325 to the ADLP. At the HLE, verify that two ISO 8208 CLEAR REQUEST packets are received from the ADLP for SVCs 317 and 325. From the HLE, send the related ISO 8208 CLEAR CONFIRMATION packets back to the ADLP. At the GDLP, verify that two Mode S CLEAR REQUEST packets were received from the ADLP on Mode S channels 14 and 6 with diagnostic codes set to 23. Uplink the related Mode S CLEAR CONFIRMATION packets back to the ADLP for those channels.

b. Perform the data transmission procedures in paragraph 2.4.7.1.2 for channels 319, 320, 321, 324 and 326. Verify that the error recovery conditions on channels 317 and 325 do not affect the operations of the other open channels by confirming at the GDLP that the ADLP has forwarded the corresponding Mode S DATA packets to the GDLP.

Step 2 – Clear Open Channels

This test uses Transactions 5 and 6 to clear an open SVC. Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4 for channels 319, 320, 321, 324, 326, 329and 330.

2.4.7.1.7 ADLP Power Recovery Test

This test is designed to test the ADLP's ability to maintain its current memory contents in the event of a power failure.

Perform the call setup procedures as described in Paragraph 2.4.3.1.1 Step 2 to open a channel. Then perform the data transfer procedures as described in Paragraph 2.4.3.1.1 Step 3. Now, remove power to the ADLP for a period of time not to exceed .5 seconds. Upon power restoration, perform the data transfer procedures once again. At the GDLP, verify that the PS values of the Mode S DATA packets are now 2 and 3 since values 0 and 1 were sent previous to the power outage. Also, verify the sequence number is properly incremented and that the content of the data field is in correct order.

2.4.7.2 Single HLE and Multiple GDLPs

The Single HLE and Multiple GDLPs test procedures are designed to test the ADLP's ability to process packets when connected to a single HLE and two or more GDLPs. Before executing this test, clear the ADLP by cycling power (power off at least 10 seconds). The ADLP will send out a SEARCH request in a broadcast mode. Return a Mode S frame containing a Mode S ROUTE Packet, causing the ADLP to initialize the II Code/DTE cross reference table.

The following transactions are required in this test:

ADLP Input	ADLP Output
1. ISO 8208 CALL REQUEST	Mode S CALL REQUEST
2. Mode S CALL ACCEPT	ISO 8208 CALL ACCEPT
3. ISO 8208 DATA	Mode S DATA
4. None	ISO 8208 RECEIVE READY
5. ISO 8208 CLEAR REQUEST	ISO 8208 CLEAR CONF. Mode S CLEAR REQUEST.
6. Mode S CLEAR CONF.	None
7. ISO 8208 RESET REQUEST	Mode S RESET REQUEST ISO 8208 RESET CONF.
8. Mode S RESET CONF.	None
9. Mode S DATA	ISO 8208 DATA
10. ISO 8208 RECEIVE READY	None
11. Mode S RECEIVE READY	None
12. ISO 8208 CALL REQUEST	ISO 8208 CLEAR REQUEST Mode S CLEAR REQUEST
13. ISO 8208 CLEAR CONF.	None
14. Mode S CLEAR CONF.	None

2.4.7.2.1 Call Request Procedures

This test uses transactions 1 and 2 to open multiple channels with the ADLP. Perform the call setup procedures as specified in paragraph 2.4.3.1.1 Step 2 fifteen times using the following ISO 8208 SVCs: 316 through 330 (inclusive). For channels 316 to 321, set the ground DTE address to 15 in the DTE address field of the ISO CALL REQUEST packets. For channels 322 to 330, set the ground DTE address to 14 in the DTE address field of the ISO CALL REQUEST packets. At the GDLP, verify that the Mode S CALL REQUEST packets received from the ADLP for Mode S channels 10 to 15 contain the ground DTE address set to 15, and Mode S channels 1 to 9 contain ground DTE address set to 14.

2.4.7.2.2 Data Transmission Procedures

From the HLE, send ISO 8208 DATA packets with 20 bytes of user data on all of the open SVCs to the ADLP. At the GDLP, verify that all the necessary Mode S DATA packets are received from the ADLP for Mode S channels 1 to 15. Verify the user data on all Mode S channels for order and content.

2.4.7.2.3 Clear Request Procedures

This test uses Transactions 5 and 6 to clear opened SVCs. Perform the clear request procedures in paragraph 2.4.3.1.1 Step 4 for channels 318 and 323. Repeat the data transmission procedures and verifications as in paragraph 2.4.7.2.2.

2.4.7.2.4 Reset Honest Procedures

This test uses Transactions 7 and 8 to reset SVCs. Repeat the Reset Request Procedures in paragraph 2.4.5.1.3 Step 1 for channels 317, 321 and 326. Repeat the data transmission procedures and verifications as in paragraph 2.4.7.2.2.

2.4.7.2.5 Receive Not Ready Status

Perform the procedures in paragraph 2.4.7.1.5.

2.4.7.2.6 Error Recovery Procedures

Perform the procedures in paragraph 2.4.7.1.6.

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3 INSTALLED EQUIPMENT PERFORMANCE

3.1 Equipment Installation

The following paragraphs apply to installation of the ADLP.

3.1.1 Accessibility

Where controls or monitors are provided for in-flight operation, they shall be readily accessible from the appropriate operator's normal seated position. The operator/crew member(s) shall have an unobstructed view of the display(s) or controls when in the normal seated position.

3.1.2 Aircraft Environment

Equipment shall be compatible with the environmental conditions present in the specific location in the aircraft where the equipment is installed.

3.1.3 Display Visibility

Where cockpit displays are provided, they shall be readily visible and readable from the operator's/crew member's normal position in all ambient lighting conditions for which system use is required.

Note: *Visors, glare shields or filters may be an acceptable means of obtaining daylight visibility.*

3.1.4 Inadvertent Turn Off

Where controls for ADLP operation are provided, they shall be equipped with adequate protection against inadvertent turn off.

3.1.5 Failure Protection

Any failure of the equipment shall not degrade the normal operation of the equipment or systems connected to it. Likewise, the failure of interfaced equipment shall not degrade normal operation of this equipment.

3.1.6 Interface Effects

The equipment shall not be the source of conducted or radiated interference, nor be affected by conducted or radiated interference from other equipment or systems installed in the aircraft.

Note: *Interference problems noted upon installation of this equipment may result from such factors as the design characteristics of previously installed systems or equipment and the physical installation itself. It is not intended that the equipment manufacturer design for all installation environments. The installing facility will be responsible for resolving any incompatibility between this equipment and previously installed equipment in the aircraft.*

3.1.7 Aircraft Power Source

The voltage and frequency tolerance characteristics of the equipment shall be compatible with the aircraft power source of appropriate category as specified in RTCA/DO-160D.

3.2 Installed Equipment Performance Requirements

The installed equipment shall meet the requirements of Section 2.0 in addition to the requirements stated below.

Power Fluctuations

The equipment shall retain memory through aircraft power changeover from external power to internal power, either battery or auxiliary power unit (APU) supplied. The equipment shall also continue to operate through changeover from battery or APU power to engine power. The ADLP is required to retain memory through loss of power during changeover for a period of up to 0.5 seconds maximum.

During changeover, shall not require reinitialization, and the contents of memory shall not be lost.

Cycle the aircraft engine(s) through all normal power settings, and verify the requirements for ADLP integrity during power changeover.

3.3 Conditions of Test

The following subsections define conditions under which tests, specified in Subsection 3.4, shall be conducted.

3.3.1 Power Input

Tests may be conducted either with the equipment powered by the aircraft's electrical power generation system or by an appropriate external power source connected to the aircraft.

3.3.2 Interference Effects

Unless otherwise specified, all aircraft electrically operated equipment and systems shall be on before conducting interference tests.

With the equipment energized from the aircraft's electrical power generating system, individually operate each of the other electrically operated aircraft equipment and systems to determine that no significant conducted or radiated interface exists. Evaluate all reasonable combinations of control settings and operating modes. Operate communication and navigation equipment on at least the low, high and one mid-band frequency.

Operate the aircraft controls (e.g., flaps) through their range to activate all associated aircraft systems which may cause electrical power fluctuations.

Note: *Some aircraft contain cooling fans which augment airflow under certain low speed conditions. These fans are activated with flaps extension and low to mid throttles, and cause aircraft power fluctuations when activated.*

3.3.3 Environment

During the tests, the equipment shall not be subjected to environmental conditions that exceed those in RTCA/DO-160D as specified by the equipment manufacturer.

3.3.4 Adjustment of Equipment

Circuits of the equipment under test shall be properly aligned and otherwise adjusted in accordance with the manufacturer's recommended practices prior to application of the specified tests.

3.3.5 Warm Up Period

Unless otherwise specified, tests shall be conducted after a warm-up (stabilization) period of not more than 15 minutes.

3.4 Test Procedures for Installed Equipment Performance

The following test procedures provide one means of determining installed equipment performance. Although specific test procedures are cited, it is recognized that other methods may be preferred by the installing activity. These alternate procedures may be used if they provide at least equivalent information. In such cases, the procedures cited herein should be used as one criterion in evaluating the acceptability of the alternate procedures.

3.4.1 Conformity Inspection

Visually inspect the installed equipment to determine the use of acceptable workmanship and engineering practices. Verify that proper mechanical and electrical connections have been made and that the equipment has been located and installed in accordance with the manufacturer's recommendations.

3.4.2 Interference Tests

Note: *See Subsection 3.4.3 of this MOPS for suggested procedures for generating Data Link Messages.*

With the equipment operating, perform the interference effects test described in Subsection 3.3.2. Send and receive data link messages, and verify that the equipment continues to operate without reinitialization.

3.4.3 Ground Test and Flight Test Procedures

Note: *This test can be performed in areas where reliable Mode S coverage exists, or by using a portable (non-connected) ground simulator capable of simulating Mode S Data Link. Flight demonstration of installed performance may be required by the aircraft airworthiness certification procedure.*

With the equipment on and operating, request at least three services available through the Mode S sensor or three simulated services from the ground test equipment.

Verify that all messages are delivered within the time normally required for two revolutions of the local Mode S sensor.

3.4.4 Power Fluctuation Test

With the equipment operating, perform the power fluctuation test described in Subsection 3.2. 1. Use the procedures described in Subsection 3.4.3 to send and receive data link messages and verify that the equipment continues to operate without reinitialization.

REFERENCES

1. RTCA/DO-178B, "Software Considerations in Airborne Systems and Equipment Certification," December 1, 1992.

2. ISO 8208, "X.25 Packet Layer Protocol for Data Terminal Equipment," 1990.

3. RTCA/DO-181C, "Minimum Operational Performance, Standards for Air Traffic Control Radar Beacon System/Mode Select Airborne Equipment," June 12, 2001.

4. RTCA/DO-160D, "Environmental Condition and Test Procedures for Airborne Equipment," July 29, 1997.

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Appendix A

STATE DIAGRAMS

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Appendix A – DCE AND XDCE STATE TABLES

A. 1 State Table Requirements The DCE and XDCE shall function as specified in the state tables contained in Tables A-1 to A-18. Tables A-10 through A-18 shall specify the ADLP state transitions when the XDCE or XDLP terms in parenthesis are omitted. These tables shall specify the GDLP state transitions when the terms in parenthesis are used and the XDCE or XDLP preceding them are omitted. All Diagnostic and Cause codes shall be interpreted as decimal numbers.

A.2 Diagnostic and Cause Codes The table entries for certain conditions indicate a diagnostic code that shall be included in the packet generated when entering the state indicated. The term, “D =,” shall define the diagnostic code. When "A = DIAG," the action taken shall be to generate an ISO 8208 DIAGNOSTIC Packet and transfer it to the DTE; the diagnostic code indicated shall define the entry in the Diagnostic Field of the packet. The Cause Field shall always be set as specified in 2.2.4.3.3. The reset cause field shall be set as specified in ISO 8208.

A.3 General Notes

Notes:

1. *All tables specify both ADLP and GDLP actions.*

2. *Within the Mode S subnetwork, states p6 and d2 are transient states.*

3. *References to "notes" in the tables refer to table-specific notes that follow each state table.*

4. *The term "ISO 8208" in the table-specific notes refers to the version of ISO 8208 defined in Reference 2.*

5. *An SVC between an ADCE an a GDCE may be identified by a temporary and/or permanent channel number, as defined in 2.2.3.1.2.*

Table A-1 DCE Special Cases

Received From DTE	DCE SPECIAL CASES
	ANY STATE
Any Packet less than 2 bytes in length (including a valid Data Link Level frame containing no packet)	A = DIAG D = 38
Any Packet with an Invalid General Format Identifier	A = DIAG D = 40
Any Packet with a valid General Format Identifier and an assigned Logical Channel Identifier (includes a Logical Channel Identifier of 0)	See Table A-2

Table A-2 DTE Effect on DCE Restart States

Packet Received From DTE	DCE RESTART STATES (See Note 5)		
	PACKET LEVEL READY (See Note 1) r1	DTE RESTART REQUEST r2	DCE RESTART REQUEST r3
Packets having a Packet Type Identifier shorter then I byte and logical channel identifier not equal to 0	See Table A-3	A = ERROR S = r3 D = 38 (See Note 4)	A = DISCARD
Any Packet, except RESTART, REGISTRATION (if supported) with a logical channel Identifier of 0	A = DIAG D = 36	A = DIAG D = 36	A = DIAG D = 36
Packet with a Packet Type Identifier which is undefined or not supported by DCE	See Table A-3	A = ERROR S = r3 D = 33 (See Note 4)	A = DISCARD
RESTART REQUEST, RESTART CONFIRMATION, or REGISTRATION (if supported) packet with a Logical Channel Identifier unequal to 0	See Table A-3	A = ERROR S = r3 D = 41 (See Note 4)	A = DISCARD
RESTART REQUEST	A = NORMAL (Forward) S=r2	A = DISCARD	A = NORMAL S = p1 or d1 (See Note 2)

Table A-2 DTE Effect on DCE Restart States (cont.)

Packet Received From DTE	DCE RESTART STATES (See Note 5)		
	PACKET LEVEL READY (See Note 1) r1	**DTE RESTART REQUEST r2**	**DCE RESTART REQUEST r3**
RESTART CONFIRMATION	A = ERROR S = r3 D = 17 (See Note 6)	A = ERROR S = r3 D = 18 (See Note 4)	A = NORMAL S = pi or d1 (See Note 2)
RESTART REQUEST or RESTART CONFIRMATION Packet with a format error	A = DIAG D = 38, 39, 81 or 82	A = DISCARD	A = ERROR D = 38, 39, 81 or 82
REGISTRATION REQUEST or REGISTRATION CONFIRMATION Packets (See Note 3)	A = NORMAL	A = NORMAL	A = NORMAL
REGISTRATION REQUEST or REGISTRATION CONFIRMATION Packet with a format error (See Note 3)	A = DIAG D = 38, 39, 81 or 82	A = ERROR S = r3 D = 38, 39, 81 or 82 (See Note 4)	A = ERROR D = 38, 39, 81 or 82
Call Setup, Cam clearing, DATA, Interrupt. Flow Control, or Reset Packet	See Table A-3	A = ERROR S = r3 D =18	A = DISCARD

Notes:

1. *The Mode S subnetwork has no restart states. Receipt of a RESTART REQUEST causes the DCE to respond with a RESTART CONFIRMATION. The RESTART REQUEST packet is forwarded to the Reformatting process, which Issues CLEAR requests for all SVCs associated with the DTE. The DCE enters the r3 state only as a result of an error detected on the DTE/DCE interface.*

2. *The SVC channels are returned to state p1, the PVC channels are returned to state d1.*

3. *The use of the registration facility is optional on the DTE/DCE interface.*

4. *No action is taken within the Mode S subnetwork.*

5. *Table entries are defined as follows: A=action to be taken, S=the state to be ordered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

6. *The error procedure consists of ordering the r3 state, and sending a RESTART REQUEST to the Reformatting Process.*

Table A-3 DTE Effect on DCE Call Setup and Clearing States

Packet Received From DTE	DCE CALL SETUP & CLEARING STATES (See Note 6)				
	READY pl	DTE CALL REQUEST p2	DCE CALL REQUEST p3	DATA TRANSFER p4	CALL COLLISION p5 (See Note 1 & 4)
Packet having a Packet Type Identifier shorter then I byte	A = ERROR S = p7 D = 38	A = ERROR S = p7 D = 38 (See Note 2)	A = ERROR S = P7 D = 38 (See Note 2)	See Table A-4	A = ERROR S = p7 D = 38 (See Note 2)
Packet having a Packet Type Identifier which is undefined or not supported by DCE	A = ERROR S = p7 D = 33	A = ERROR S = P7 D = 33 (See Note 2)	A = ERROR S = p7 D = 33 (See Note 2)	See Table A-4	A = ERROR S = p7 D = 33 (See Note 2)
RESTART REQUEST, RESTART CONFIRMATION or REGISTRATION packet with Logical Channel Identifier unequal to 0	A = ERROR S = p7 D = 41	A = ERROR S = p7 D =41 (See Note 2)	A = ERROR S = p7 D = 41 (See Note 2)	See Table A-4	A = ERROR S = P7 D =41 (See Note 2)
CALL REQUEST	A = NORMAL S = p2 (Forward)	A = ERROR S = p7 D =21 (See Note 2)	A = NORMAL S = p5	A = ERROR S = P7 D =23 (See Note 2)	A = ERROR S = p7 D = 24 (See Note 2)
CALL ACCEPT	A = ERROR S = P7 D = 20	A = ERROR S = p7 D =21 (See Note 2)	A = NORMAL S = p4 (Forward) or A = ERROR S = p7 D = 42 (See Note 2 & 3)	A = ERROR S = P7 D = 23 (See Note 2)	A = ERROR S = P7 D = 24 (See Notes 2 & 4)
CLEAR REQUEST	A = NORMAL S = p6	A = NORMAL S = p6 (Forward)	A = NORMAL S = p6 (Forward)	A = NORMAL S = p6 (Forward)	A = NORMAL S = p6 (Forward
CLEAR CONFIRMATION	A = ERROR S = P7 D = 20	A = ERROR S = P7 D = 21 (See Note 2)	A = ERROR S = p7 D = 22 (See Note 2)	A = ERROR S = p7 D = 23 (See Note 2)	A = ERROR S = p7 D = 24 (See Note 2)
DATA, interrupt, Flow Control or Reset Packets	A = ERROR S = p7 D = 20	A = ERROR S = p7 D = 21 (See Note 2)	A = ERROR S = p7 D = 22 (See Note 2)	See Table A-4	A = ERROR S = p7 D = 24 (See Note 2)

Table A-3 DTE Effect on DCE Call Setup and Clearing States (cont.)

Packet Received From DTE	**DCE CALL SETUP AND CLEARING STATES (See Note 6)**	
	DTE CLEAR REQUEST **p6**	**DCE CLEAR Request to DTE** **P7**
Packet having a Packet Type Identifier shorter than 1 Byte	A = ERROR S = p7 D = 38 (See Note 2)	A = DISCARD
Packet having a Packet Type Identifier which is undefined or not supported by DCE	A = ERROR S = p7 D = 33 (See Note 2)	A = DISCARD
RESTART REQUEST, RESTART CONFIRMATION or Registration packet with Logical Channel Identifier unequal to 0	A = ERROR S = p7 D = 41 (See Note 2)	A = DISCARD
CALL REQUEST	A = ERROR S = p7 D =25 (See Note 2)	A = DISCARD
CALL ACCEPT	A = ERROR S = P7 D =25 (See Note 2)	A = DISCARD
CLEAR REQUEST	A = DISCARD	A = NORMAL S = p1 (do not forward)
CLEAR CONFIRMATION	A = ERROR S = p7 D =25 (See Note 2)	A = NORMAL S = p1 (do not forward)
DATA, Interrupt Flow Control, or Reset Packets	A = ERROR S = p7 D =25 (See Note 2)	A = DISCARD

Notes:

1. *On entering the p5 state, the DCE reassigns the outgoing call to the DTE to another channel (no CLEAR REQUEST is issued) and responds to incoming DTE call as appropriate with a CLEAR REQUEST or CALL ACCEPT packet.*

2. *The error procedure consists of performing the actions specified when entering the p7 state (including sending a CLEAR REQUEST Packet to the DTE) and additionally sending a CLEAR REQUEST Packet to the XDCE (via the Reformatting Process).*

3. *The use of the Fast Select Facility with a restriction on the response prohibits the DTE from sending a CALL ACCEPT packet.*

4. *The DTE in the event of a Call Collision must discard the CALL REQUEST packet received from the DCE.*

5. *Table entries are defined as follows: A=action to be taken, S=the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

Table A-4 DTE Effect on DCE Reset States

PACKET RECEIVED FROM DTE	**DCE RESET STATES (See Note 2)**		
	FLOW CONTROL READY d1	**RESET REQUEST BY DTE d2**	**DCE RESET REQUEST TO DTE d3**
Packet with a Packet Type identifier shorter than 1 byte	A = ERROR S = d3 D = 38 (See Note 1)	A = ERROR S = d3 D = 38 (See Note 1)	A = DISCARD
Packet with a Packet Type identifier which is undefined or not supported by DCE	A = ERROR S = d3 D = 33 (See Note 1)	A = ERROR S = d3 D = 33 (See Note 1)	A = DISCARD
RESTART REQUEST, RESTART CONFIRMATION, or REGISTRATION (if supported) packet with Logical Channel Identifier unequal to 0	A = ERROR S = d3 D = 41 (See Note 1)	A = ERROR S = d3 D = 41 (See Note 1)	A = DISCARD
RESET REQUEST	A = NORMAL S = d2 (forward)	A = DISCARD	A = NORMAL S = d1 (do not forward)
RESET CONFIRMATION	A = ERROR S = d3 D = 27 (See Note 1)	A = ERROR S = d3 D = 28 (See Note 1)	A = NORMAL S = d1 (do not forward)

Table A-4 DTE Effect on DCE Reset States (cont.)

PACKET RECEIVED FROM DTE	**DCE RESET STATES (See Note 2)**		
	FLOW CONTROL READY **d1**	**RESET REQUEST By DTE** **d2**	**RESET REQUEST 13Y DCE TO DTE** **d3**
INTERRUPT Packet	See Table A-5	A = ERROR S = d3 D =28 (See Note 1)	A = DISCARD
INTERRUPT CONFIRMATION Packet	See Table A-5	A = ERROR S = d3 D = 28 (See Note 1)	A = DISCARD
DATA or Flow Control packet	See Table A-6	A = ERROR S = d3 D = 28 (See Note 1)	A = DISCARD
REJECT supported but not subscribed to	A = ERROR S = d3 D = 37 (See Note 1)	A = ERROR S = d3 D = 37 (See Note 1)	A = DISCARD

Notes:

1. *The error procedure consists of performing the specified actions when entering the d3 state (which includes forwarding a RESET REQUEST packet to the DTE) and sending a RESET REQUEST packet to the XDCE (via the formatting function).*

2. *Table entries are defined as follows: A=action to be taken, S=the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

Table A-5 DTE Effect on DCE Interrupt States

Packet Received From DTE	DTE/DCE INTERRUPT TRANSFER STATES (See Note 2)	
	DTE INTERRUPT READY I1	DTE INTERRUPT SENT I2
INTERRUPT (See Note 1)	A = NORMAL S = i2 (Forward)	A = ERROR S = d3 D = 44 (See Note 3)

Packet Received From DTE	DTE/DCE INTERRUPT TRANSFER STATES (See Note 2)	
	DCE INTERRUPT READY j1	DCE INTERRUPT SENT j2
INTERRUPT CONFIRMATION (See Note 1)	A = ERROR S = d3 D = 43 (See Note 3)	A = NORMAL S = j1 (Forward)

Notes:

1. *If the packet has a format error, then the error procedure apples. (See Note 3). Interrupt packets with user data greater than 32 bytes should be treated as a format error.*

2. *Table entries are defined as follows: A-action to be taken, S--the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

3. *The error procedure consists of performing the specified actions when entering the d3 state (which includes forwarding a RESET REQUEST packet to the DTE) and sending a RESET REQUEST packet to the XDCE (via the Reformatting Process).*

Table A-6 DTE Effect on Flow Control Transfer States

Packet Received From DTE	DCE FLOW CONTROL TRANSFER STATES (See Notes 2 & 3)	
	DCE RECEIVE READY f l	**DCE RECEIVE NOT READY f 2**
DATA packet with less than 4 bytes when using modulo 128 numbering.	A = ERROR S = d3 D = 38 (See Note 4)	A = DISCARD
DATA packet with Invalid PR	A = ERROR S = d3 D = 2 (See Note 4)	A = ERROR S = d3 D = 2 (See Note 4)
DATA packet with valid PR but Invalid PS or User Data Field with Improper format	A = ERROR S = d3 D = 1 (Invalid PS) D = 39 (UD>max negotiated length) D = 82 (UD unaligned) (See Note 4)	A = DISCARD (process PR data)
DATA packet with valid PR with WWI: set to I when the User Data Field is partially full	A = ERROR S = d3 D = 165 (See Note 4)	A = DISCARD (process PR data)
DATA packet with valid PR, PS and User Data Field Format	A = NORMAL (forward)	A = DISCARD (process PR data)

Table A-6 DTE Effect on Flow Control Transfer States (cont.)

Packet Received From DTE	**DCE FLOW CONTROL TRANSFER STATES (See Note 2 & 3)**	
	DTE RECEIVE READY **g1**	**DTE RECEIVE NOT READY** **g2**
RR, RNR, or reject packet with less than 3 bytes when using modulo 128 numbering (See Note 1)	A = DISCARD	A = DISCARD
RR, RNR, or REJECT packet with an Invalid PR	A = ERROR S = d3 D = 2 (See Note 4)	A = ERROR S = d3 D = 2 (See Note 4)
RR packet with a valid OR	A = NORMAL	A = NORMAL S = g1
RNR packet with a valid PR	A = NORMAL S = g2	A = NORMAL
REJECT packet with a valid PR	A = NORMAL	A = NORMAL S = g1

Notes:

1. *The Reject procedures are not required.*

2. *The RR, RNR and REJECT procedures are a local DTE/DCE matter and the corresponding packets are not forwarded to the XDCE.*

3. *Table entries are defined as follows: A=action to be taken, S=the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

4. *The error procedure consists of performing the specified actions when entering the d3 state (which includes forwarding RESET REQUEST packet to the DTE) and sending a RESET REQUEST packet to the XDCE (via the Reformatting Process).*

Table A-7 ADCE Effect on DCE Restart States

Packet Received From XDCE	**DCE RESTART STATES (See Note 1)**		
	PACKET LEVEL READY r1	**DTE RESTART REQUEST r2**	**DCE RESTART REQUEST r3**
CALL REQUEST	See Table A-8	Send CLEAR REQUEST So Reformatting Process with D = 244	Send CLEAR REQUEST to Reformatting Process with D = 244
CALL ACCEPT, CLEAR REQUEST, RESET REQUEST, DATA, INTERRUPT, INTERRUPT CONFIRMATION	See Table A-8	A = DISCARD	A = DISCARD

Note: *Table entries are defined as follows: A=action to be taken, S=the state to be entered, D=the diagnostic code to be used In packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the ADLP butters, and INVALID indicates that the packet/state combination cannot occur.*

Table A-8 ADCE Effect on DCE Call Setup and Clearing States

PACKET RECEIVED FROM XDCE	DCE CALL SETUP & CLEARING STATES (See Note 1)				
	READY p1	DTE CALL REQUEST p2	DCE CALL REQUEST p3	DATA TRANSFER p4	CALL COLLISION p5
CALL REQUEST	A = NORMAL S = p3 (forward)	INVALID	INVALID	INVALID	INVALID
CALL ACCEPT	A = DISCARD	A = NORMAL S = p4 (forward)	INVALID	INVALID	INVALID
CLEAR REQUEST	A = DISCARD	A = NORMAL S = p7 (forward)	A = NORMAL S = p7 (forward)	A = NORMAL S = p7 (forward)	INVALID
DATA, INTERRUPT, INTERRUPT CONFIRMATION, OR RESET REQUEST	A = DISCARD	INVALID	INVALID	See Table A-9	INVALID

Table A-8 ADCE Effect on DCE Call Setup and Clearing States (cont.)

PACKET RECEIVED FROM XDCE	DCE CALL SETUP & CLEARING STATES (See Note 1)	
	DTE CLEAR REQUEST p6	DCE CLEAR REQUEST TO DTE p7
CALL REQUEST	INVALID	INVALID
CALL ACCEPT	A = DISCARD	A = DISCARD
CLEAR REQUEST	A = DISCARD	A = DISCARD
DATA, INTERRUPT, INTERRUPT CONFIRMATION, OR RESET REQUEST	A = DISCARD	A = DISCARD

Note: *Table entries are defined as follows: A=action to be taken, S=the state to be entered, 13=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

Table A-9 ADCE Effect on DCE Reset States

PACKET RECEIVED FROM XDCE	DCE RESET STATES (See Note)		
	FLOW CONTROL READY d1	**DTE RESET REQUEST d2**	**DCE RESET REQUEST TO DTE d3**
RESET REQUEST	A = NORMAL S = d3 (forward)	A = NORMAL S = d1 (forward)	A = DISCARD
INTERRUPT	See Table A-10	A = DISCARD	A = DISCARD
INTERRUPT CONFIRMATION	See Table A-10	A = DISCARD	INVALID
DATA	A = NORMAL S = d1 (forward)	A = DISCARD	A = DISCARD

Note: *Table entries are defined as follows: A=action to be taken, S=the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

Table A-10 ADCE Effect on DCE Interrupt States

Received From XDCE	DCE INTERRUPT TRANSFER STATES (See Note 1)	
	DTE INTERRUPT READY I1	**DTE INTERRUPT SENT I2**
INTERRUPT CONFIRMATION	INVALID	A = NORMAL S = i1 (Forward)

Received From XDCE	DCE INTERRUPT TRANSFER STATES (See Note 1)	
	DCE INTERRUPT READY j1	**DCE INTERRUPT SENT j2**
INTERRUPT	A = NORMAL S=j2 (Forward)	INVALID

Note: *Table entries are defined as follows: A=action to be taken, S=the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the ADLP butters, and INVALID indicates that the packet/state combination cannot occur.*

Table A-11 GDLP Effect on ADCE Packet level ready States

PACKET RECEIVED FROM GDLP (ADLP) (SEE NOTE 2)	**ADCE (GDCE) STATES (See Notes 1& 3)**
	Packet Level Ready r1
CH=0 with no TC present (See Note 4) or CH=0 in a CALL ACCEPT by ADLP packet	A = DISCARD
Unassigned packet header	A = DISCARD
Call Setup, Call Clearing, DATA, Interrupt, Flow Control, or Reset	See Table A-12

Notes:

1. *The XDCE state is not necessarily the same state as the DTE/DCE interface.*

2. *All packets from the peer XDLP have been checked for duplication before evaluation as represented by this table.*

3. *Table entries are defined as follows: A=action to be taken, S--the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

4. *Where CH=0 and a valid TC is present in a CLEAR REQUEST by ADLP or GDLP packet or a CLEAR CONFIRMATION by ADLP or GDLP packet, it is handled as described in 2.2.3.1.2 and Table A-12.*

Table A-12 GDLP Effect on ADCE Call Setup and Clearing States

<table>
<tr><th rowspan="2">PACKET RECEIVED FROM GDLP (ADLP) (See Note 2)</th><th colspan="4">ADCE (GDCE) CALL SETUP AND CLEARING STATES (See Notes 1, 7 & 8)</th></tr>
<tr><th>READY
p1</th><th>GDLP (ADLP) CALL REQUEST
p2</th><th>ADCE (GDCE) CALL REQUEST
p3</th><th>DATA TRANSFER
p4</th></tr>
<tr><td>Format error (See Note 3)</td><td>A = ERROR
(See Note 10)
S = p7
D = 33
(See Note 9)</td><td>A = ERROR
S = p7
D = 33
(See Note 6)</td><td>A = ERROR
S = p7
D = 33
(See Notes 6 & 9)</td><td>See Table A-13</td></tr>
<tr><td>CALL REQUEST</td><td>A = NORMAL
(2.2.4.3.1)
S = p2 (forward Request to DCE)</td><td>A = ERROR
S = p7
D = 21
(See Note 6)</td><td>Not Applicable
(See Note 4)</td><td>Not Applicable
(See Note 4)</td></tr>
<tr><td>CALL ACCEPT</td><td>A = ERROR
S = p7
D = 20
(See Note 10)</td><td>A = ERROR
S = p7
D = 21
(See Note 6)</td><td>A = NORMAL
(2.2.4.3.1)
S = p4 (forward to DCE), or
A = ERROR
S = p7
D = 42
(See Note 6)</td><td>A = ERROR
S = p7
D = 23
(See Note 6)</td></tr>
<tr><td>CLEAR REQUEST</td><td>A = NORMAL
(2.2.4.3.3)
S = p6
(do not forward)</td><td>A = NORMAL
(2.2.4.3.3)
S = p6
(forward to DCE)</td><td>A = NORMAL
(2.2.4.3.3)
S = p6
(forward to DCE)</td><td>A = NORMAL
(2.2.4.3.3)
S = p6
(forward to DCE)</td></tr>
<tr><td>CLEAR CONFIRMATION</td><td>A = ERROR
S = p7
D = 20
(See Note 10)</td><td>A = ERROR
S = p7
D = 21
(See Note 6)</td><td>A = ERROR
S = p7
D = 22
(See Note 6)</td><td>A = ERROR
S = p7
D = 23
(See Note 6)</td></tr>
<tr><td>DATA, Interrupt, Flow Control, RESET</td><td>A = ERROR
S = p7
D = 20
(See Notes 9 & 10)</td><td>A = ERROR
S = p7
D = 21
(See Notes 6 & 9)</td><td>A = ERROR
S = p7
D = 22
(See Notes 5 & 6)</td><td>See Table A-13</td></tr>
</table>

Table A-12 GDLP Effect on ADCE Call Setup and Clearing States (cont.)

PACKET RECEIVED FROM GDLP (ADLP) (See Note 2)	**ADCE (GDCE) CALL SETUP AND CLEARING STATES (See Notes 1, 7 & 8)**	
	GDLP (ADLP) CLEAR REQUEST p6	**ADCE (GDCE) CLEAR REQUEST TO GDLP (ADLP) p7**
Format error (See Note 3 & 9)	A = ERROR S = p7 D = 25 (See Note 6)	A = DISCARD
CALL REQUEST	A = ERROR S = p7 D = 25 (See Note 6)	A = DISCARD
CALL ACCEPT	A = ERROR S = p7 D = 25 (See Note 6)	A = DISCARD
CLEAR REQUEST	A = DISCARD	A = NORMAL (2.2.4.3.3) S = p1 (do not forward packet to DCE)
CLEAR CONFIRMATION	A = ERROR S = p7 D = 25 (See Note 6)	A = NORMAL (2.2.4.3.3) S = p1 (do not forward packet to DCE)
DATA, Interrupt, Flow Control or Reset	A = ERROR S = p7 D = 25 (See Note 6)	A = DISCARD

Notes:

1. *The XDCE is not necessarily in the same state as the DTE/DCE interface.*

2. *All packets from the peer XDLP have been checked for duplication before evaluation as represented by this table.*

3. *A format error may result from an S-bit sequence having a first or intermediate packet shorter than the maximum length, or else from an invalid LV field in a CALL REQUEST, CALL ACCEPT, CLEAR REQUEST or INTERRUPT packet. There are no other detectable format errors.*

4. *The ADCE assigns all channel numbers used between the ADLP and GDLP, hence call collisions are not possible. When a CALL REQUEST by GDLP Packet is received bearing a temporary channel number associated with an SVC in the p4 State, the association of the temporary to permanent channel number is broken (2.2.3.1.2).*

5. *Not applicable to the GDLP.*

6. *The error procedure consists of performing the actions specified when entering the p7 state (including sending a CLEAR REQUEST Packet to the peer XDLP) and additionally sending a CLEAR REQUEST Packet to the DCE (via the Reformatting Process).*

7. *Table entries are defined as follows: A=action to be taken, S--the state to be entered, 13=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

8. *The number in parentheses below an "A=NORMAL" table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*

9. *An error condition is declared and transfer to the p7 state is possible only if the ground DTE address is known unambiguously. Otherwise Vie action is to discard the packet.*

10. *The error procedure consists of performing the action when entering the p7 state (including sending a CLEAR REQUEST Packet to the XDLP) but without sending a CLEAR REQUEST Packet to the local DCE.*

Table A-13 GDLP Effect on ADCE Reset States

PACKET RECEIVED FROM GDLP (See Note 2)	ADCE RESET STATES (See Notes 1, 4 & 5)		
	FLOW CONTROL READY d1	GDLP RESET REQUEST d2	ADCE RESET REOUEST TO GDLP d3
RESET REQUEST	A = NORMAL (2.2.4.7) S = d2 (forward to DCE)	A = DISCARD	A = NORMAL (2.2.4.7) S = d1 (do not forward packet)
RESET CONFIRMATION	A = ERROR S = d3 D = 27 (See Note 3)	A = ERROR S = d3 D = 28 (See Note 3)	A = NORMAL (2.2.4.7) S = d1 (do not forward packet)
INTERRUPT	See Table A-14	A = ERROR S = d3 D =28 (See Note 3)	A = DISCARD
INTERRUPT CONFIRMATION	See Table A-14	A = ERROR S =d3 D = 28 (See Note 3)	A = DISCARD
DATA or Flow Control Packet	Se Table A-15	A = ERROR S = d3 D =28 (See Note 3)	A = DISCARD
Format error (See Note 6)	A = ERROR S = d3 D = 33 (See Note 3)	A = ERROR S = d3 D = 33 (See Note 3)	A = DISCARD

Notes:

1. *The ADCE is not necessarily in the same state as the DTE/DCE Interface.*

2. *All packets from the GDLP have been checked for duplication before evaluation as represented by this table.*

3. *The error procedure consists of performing the specified actions when entering the d3 state (which includes forwarding a RESET REQUEST packet to the GDLP) and sending a RESET REQUEST packet to the DCE (via the reformatting function).*

4. *Table entries are defined as follows: A=action to be taken, S--the state to be entered, D=the diagnostic code to be used In packets generated as a result of this action, DISCARD indicates that the received packet is Io be cleared from the ADLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

5. *The number in parentheses below an "A=NORMAL" table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*

6. *A format error may result from an S-bit sequence having a first or intermediate packet shorter than the maximum length, or else from an invalid LV field in a CALL REQUEST, CALL ACCEPT, CLEAR REQUEST, or INTERRUPT packet. There are no other detectable Mode S format errors.*

Table A-14 GDLP Effect on ADCE Interrupt Transfer States

RECEIVED FROM GDLP (See Note 2)	**ADCE INTERRUPT TRANSFER STATES (See Notes 1 , 3 & 4)**	
	GDLP INTERRUPT READY I1	**GDLP INTERRUPT SENT I2**
INTERRUPT (See Note 6)	A = NORMAL (2.2.4.2.7) S = i2 (forward to DCE)	A = ERROR S = d3 D = 44 (See Note 5)

RECEIVED FROM GDLP (ADLP) (See Note 2)	**ADCE (GDCE) INTERRUPT TRANSFER STATES (See Notes 1, 3 & 4)**	
	ADCE (GDCE) INTERRUPT READY j1	**ADCE (GOCE) INTERRUPT SENT j2**
INTERRUPT CONFIRMATION	A = ERROR S = d3 D = 43 (See Note 5)	A = NORMAL (2.2.4.2.7) S = j1 (forward confirmation to DCE)

Notes:

1. *The ADCE is not necessarily in the same state as the DTE/DCE interface.*

2. *All packets from the GDLP have been checked for duplication before evaluation as represented by this table.*

3. *Table entries are defined as follows: A=action to be taken, S--the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the ADLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

4. *The number in parentheses below an "A=NORMAL" table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*

5. *The error procedure consists of performing the specified actions when entering the d3 state (which includes forwarding a RESET REQUEST packet to Me peer XDLP) and sending a RESET REQUEST packet to the DCE (via the Reformatting process).*

6. *User data length for INTERRUPT packets greater than 32 bytes, or an out of sequence INTERRUPT packet, are considered as errors.*

Table A-15 GDLP Effect on ADCE Flow Control Transfer States

PACKET RECEIVED FROM GDLP (See Note 2)	ADCE FLOW CONTROL TRANSFER STATES (See Notes 1, 6 & 7)	
	ADCE RECEIVE READY f1	ADCE RECEIVE NOT READY f2
DATA packet with Invalid PR (See Note 3)	A = ERROR S = d3 D = 2 (See Note 8)	A = ERROR S = d3 D = 2 (See Note 8)
DATA packet with valid PR, Invalid PS or LV subfield (See Notes 4 & 5)	A = DISCARD but process the PR value and send REJECT packet containing the expected PS value (See Note 5).	A = DISCARD, but process the PR value and send REJECT packet containing the expected PS value when busy condition ends
DATA packet with valid PR, PS and LV subfield	A = NORMAL (2.2.4.4) (forward)	A = PROCESS, if possible; or A = DISCARD but process the PR value and send REJECT containing the expected PS value when busy condition ends.

Table A-15 GDLP Effect on ADCE Flow Control Transfer States (cont.)

PACKET RECEIVED FROM GDLP (See Note 2)	ADCE FLOW CONTROL TRANSFER STATES (See Notes 1, 6, & 7)	
	GDLP RECEIVE READY g1	GDLP RECEIVE NOT READY g2
RR, RNR, REJECT packet with Invalid PR (See Note 3)	A = ERROR S = d3 D = 2 (See Note 8)	A = EFL90R S = d3 D = 2 (See Note 8)
RR with valid PR field (See Note 9)	A = NORMAL (2.2.4.5)	A = NORMAL (2.2.4.6) S = g1
RNR with valid PR value (See Note 9)	A = NORMAL (2.2.4.5) S = g2	A = NORMAL (2.2.4.6)
REJECT with valid PR (See Note 9)	A = NORMAL (2.2.4.5)	A = NORMAL (2.2.4.6) S = g1

Notes:

1. *The XDCE is not necessarily in the same state as the DTE/DCE interface.*

2. *All packets from the peer XDLP have been checked for duplication before evaluation as represented by this table.*

3. *An Invalid PR value is one which is less than the PR value (modulo 16) of the last packet sent by the poor XDLP. or greater than the PS value of the next data packet to be transmitted by the XDLP.*

4. *An invalid PS value is one which is different from the next expected value for PS.*

5. *An invalid LV field subfield is one which represents a value that is too large for the size of the segment received. In the event of an LV field error which gives rise to a loss of confidence in the correctness of the other fields in the packet, the packet is discarded without any further action.*

6. *Table entries are defined as follows: A=action to be taken, S--the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the XDLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

7. *The number in parentheses below an "A=NORMAL" table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*

8. *The error procedure consists of performing the specified actions when entering the d3 state (which includes forwarding a RESET REQUEST packet to the poor XDLP) and sending a RESET REQUEST packet to the DCE (via the Reformatting process).*

9. *RR, RNR, and REJECT packets have no end-to-end significance and are not forwarded to the DCE.*

10. *The receipt of a packet smaller than the maximum packet size with M-bit = 1 shall cause a reset to be generated and the remainder of the sequence shall be discarded.*

Table A-16 DCE Effect on ADCE Call Setup and Clearing States

PACKET RECEIVED FROM DCE (See Notes 2 & 4)	ADCE (GDCE) CALL SETUP AND CLEARING STATES (See Notes 1, 7 & 8)			
	READY p1	GDLP (ADLP) CALL REQUEST p2	ADCE (GDCE) CALL REQUEST p3	DATA TRANSFER p4
CALL REQUEST (See Note 6)	A = NORMAL (2.2.4.3.1) S = p3 (forward)	INVALID (See Note 5)	INVALID (See Note 3)	INVALID (See Note 3)
CALL ACCEPT (See Note 4)	A = DISCARD	A = NORMAL S = p4 (forward)	INVALID (See Note 3)	INVALID (See Note 3)
CLEAR REQUEST (See Note 4)	A = DISCARD	A = NORMAL (2.2.4.3.3) S = p7 (forward)	A = NORMAL (2.2.4.3.3) S = p7 (forward)	A = NORMAL (2.2.4.3.3) S = p7 (forward)
DATA, INTERRUPT or RESET Packets (See Note 4)	A = DISCARD	INVALID (See Note 3)	INVALID (See Note 3)	See Table A-17

Table A-16 DCE Effect on ADCE Call Setup and Clearing States (cont.)

PACKET RECEIVED FROM DCE (See Notes 2 & 4)	ADCE (GDCE) CALL SETUP AND CLEARING STATES (See Notes 1, 7 & 8)	
	CLEAR REQUEST BY GDLP (ADLP) p6	CLEAR REQUEST BY ADCE (GDCE) TO GDLP (ADLP) p7
CALL REQUEST (See Note 6)	INVALID (See Note 3)	INVALID (See Note 3)
CALL ACCEPT	A = DISCARD	A = DISCARD
CLEAR REQUEST	A = DISCARD	A = DISCARD
DATA, Interrupt or reset packets	A = DISCARD	A = DISCARD

Notes:

1. *The ADCE is not necessarily in the same state as the DTE/DCE interface.*

2. *This is the DTE packet received via the DCE after all DTE/DCE processing has occurred. Procedures local to the DTE/DCE interface (such as RR, RNR, and Reject if in effect), do not affect the ADCE directly. All error procedures as documented in ISO 8208 have been performed. Hence certain packets are rejected by the interface and are not represented in this table.*

3. *The DCE in its protocol operation with the DTE will detect this error condition, hence the erroneous packet can be said never to “reach" to ADCE; see also Note 2.*

4. *The channel number for the DTE/DCE need not be the same channel number used for the ADCE/GDCE; a packet from the DTE which contains a channel number is associated with an air/ground channel by means of a previously established cross reference table. It none exists then the DTE/DCE channel by definition references an air/ground channel in the p1 state.*

5. *The ADCE assigns all channels numbers used between the ADLP and GDLP; hence Call collisions (denoted p5 ISO 8208) are not possible. Also see note 4.*

6. *A CALL REQUEST from the DTE can never be associated with an ADCE channel number which is not in the p1 state.*

7. *Table entries are defined as follows: A=action to be taken, S=the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the ADLP buffers, and INVALID indicates that the packettstate combination cannot occur.*

8. *The number in parentheses below an "A = NORMAL" table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet if no paragraph number is referenced, the normal processing is defined in the table entry.*

Table A-17 DCE Effects on ADCE Reset States

PACKET RECEIVED FROM DCE	ADCE RESET STATES (See Notes 1, 4 & 5)		
	FLOW CONTROL READY d1	GDLP (ADLP) RESET REQUEST d12	ADCE (GDCE) RESET REQUEST TO GDLP (ADLP) d3
RESET REQUEST	A = NORMAL (2.2.4.7) S = d3 (forward)	A = NORMAL (2.2.4.7) S = d1 (forward)	A = DISCARD
RESET CONFIRMATION	INVALID (See Note 3)	INVALID (See Note 3)	INVALID (See Note 3)
INTERRUPT	See Table A-18	A = DISCARD	Hold Interrupt until Mode S reset complete
INTERRUPT CONFIRMATION	See Table A-18	A = DISCARD	INVALID (See Note 3)
DATA (See Note 2)	A = NORMAL (2.2.4.7) (forward)	A = DISCARD	Hold data until Mode S reset complete

Notes:

1. *The ADCE is not necessarily in the same state as the DTE/DCE interface.*

2. *This is the DTE packet received via the DCE after all DTE/DCE processing has occurred. Procedures local to the DTE/DCE interface (such as RR, RNR, and Reject 11 in effect) do not affect the ADCE directly. All a= procedures as documented in ISO 8208 have been performed. Hence certain packets are rejected by the interface and are not represented in this table.*

3. *The DCE in its protocol operation with the DTE will detect this error condition, hence the erroneous packet can be said never to "reach" the ADCE; see also Note 2.*

4. *Table entries are defined as follows: A=action to be taken, S=the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the ADLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

5. *The number in parentheses below an "A=NORMAL" table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. if no paragraph number is referenced, the normal processing is defined in the table entry.*

Table A-18 DCE Effect on DCE Interrupt Transfer States

RECEIVED FROM DCE (See Note 2)	ADCE INTERRUPT TRANSFER STATE (See Notes 1, 4 & 6)	
	GDLP INTERRUPT READY I1	GDLP) INTERRUPT SENT i2
INTERRUPT CONFIRMATION PACKET	INVALID (See Note 3)	A NORMAL (2.2.4.4.6) S = i1 (forward)

RECEIVED FROM DCE (SEE NOTE 2)	ADCE INTERRUPT TRANSFER STATES (See Notes 1, 4 & 6)	
	ADCE INTERRUPT READY j1	ADCE) INTERRUPT SENT j2
INTERRUPT PACKET	A = NORMAL (2.2.4.4.5) S = j2 (forward)	INVALID (See Note 3)

Notes:

1. *The ADCE is not necessarily in the same state as the DTE/DCE interface.*

2. *This is the DTE packet received via the DCE after all DTE/DCE processing has occurred Procedures local to the DTE/DCE interface (such as RR, RNR, and Reject if in effect), do not effect the ADCE directly. An error procedures as documented in ISO 8208 have been performed. Hence certain packets are rejected by the interface and are not represented in this state.*

3. *The DCE in the protocol operation with the DTE will detect this error condition, hence the erroneous packet can be said never to “reach” the ADCE; see also Note 2.*

4. *Table entries are defined as follows: A=action to be taken, S=the state to be entered, D=the diagnostic code to be used in packets generated as a result of this action, DISCARD indicates that the received packet is to be cleared from the ADLP buffers, and INVALID indicates that the packet/state combination cannot occur.*

5. *The number in parentheses below an "A=NORMAL" table entry is the paragraph number in this document that defines the actions to be taken to perform normal processing on the received packet. If no paragraph number is referenced, the normal processing is defined in the table entry.*

Appendix B

MODE S PACKET FORMATS

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Appendix B – MODE S PACKET FORMATS

B.1 Definition of Packet Formats The Mode S packet formats shall be as specified in Figures B-1 to B-20.

B.2 Significance of Control Fields The structure of the format control fields used in Mode S packets shall be as specified in Figure B-21. The significance of all control fields used in these packet formats shall be as follows:

Field Symbol	Definition
AG	Address, Ground; the 8-bit binary representation of the ground DTE address (2.2.1.1.2. 1).
AM	Address, Mobile; the 4-bit binary representation of the last two BCD digits of the mobile DTE address (2.2.1.1.2.2).
CC	Clearing Cause as defined in ISO 8208 [Ref. 2].
CH	Channel number (0 to 15).
DC	Diagnostic Code as defined in ISO 8208 [Ref. 2].
DP	Data Packet Type (Figure B-21).
F	S-bit Sequence, First Packet Flag
FD	Fast Select User Data
FILL	Fill Field. FILL1 has a length of 6 bits for a non-multiplexed packet in a downlink SLM frame. Otherwise it is 0 bits. FILL2 has a length of 0 bits for a non-multiplexed packet in a downlink SLM frame and for a multiplexing header; otherwise it is 2 bits.
FIRST PACKET	The contents of the first of the multiplexed packets.
FL	Fast Select User Data Length
FS	Fast Select Present
IN	Initialization Bit
L	"More Bit" for long form MSP Packets as specified in 2.2.6.3.
LAST PACKET	The contents of the last of the multiplexed packets.
LENGTH	The length of a multiplexed packet in bytes expressed as an unsigned binary number.

LV	User Data Field length; number of user bytes as specified in 2.2.5.3.7.
M	"More Bit" for SVC DATA Packets as specified in 2.2.3.1.4. 1.
M/CH	MSP channel number.
MP	MSP Packet Type (Figure B-21).
M/SN	Sequence number; the sequence number for the Long Form MSP packet.
OF	Option Flag.
OD	Optional Data.
ODL	Optional Data Length.
P	Priority Field.
PR	Packet receive sequence number.
PS	Packet send sequence number.
RC	Resetting Cause code as defined in ISO 8208 [Ref. 2].
RT	Route Table as defined in 2.2.3.3.3.
RTL	Route Table Length expressed in bytes.
S	"More Bit” for CALL REQUEST, CALL ACCEPT CLEAR REQUEST and INTERRUPT Packets as specified in 2.2.3.1.4.2.
SN	Sequence number; the sequence number for this packet type.
SP	Supervisory packet (Figure B-21).
SS	Supervisory subset number (Figure B-21).
ST	Supervisory Type (Figure B-21).
TC	Temporary channel number (1 to 3).
UD	User Data Field.

1	2	3	4	5	6	7	8
DP=0	MP=1	SP=1		ST=0		FILL2	
P	FILL	SN					
CH				AM			
AG							
S	FS		F	LV			
UD							

Figure B-1 Call Request by ADLP Packet

1	2	3	4	5	6	7	8
DP=0	MP=1	SP=1		ST=0		FILL	
P	FILL	SN					
FILL		TC		AM			
AG							
S	FS		F	LV			
UD							

Figure B-2 Call Request by GDLP Packet

<table>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>DP=0</td><td>MP=1</td><td colspan="2">SP=1</td><td colspan="2">ST=1</td><td colspan="2">FILL2</td></tr>
<tr><td colspan="2">TC</td><td colspan="6">SN</td></tr>
<tr><td colspan="4">CH</td><td colspan="4">AM</td></tr>
<tr><td colspan="8">AG</td></tr>
<tr><td>S</td><td colspan="2">FILL</td><td>F</td><td colspan="4">LV</td></tr>
<tr><td colspan="8">UD</td></tr>
</table>

Figure B-3 Call Accept By ADLP Packet

<table>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>DP=0</td><td>MP=1</td><td colspan="2">SP=1</td><td colspan="2">ST=1</td><td colspan="2">FILL</td></tr>
<tr><td colspan="2">FILL</td><td colspan="6">SN</td></tr>
<tr><td colspan="4">CH</td><td colspan="4">AM</td></tr>
<tr><td colspan="8">AG</td></tr>
<tr><td>S</td><td colspan="2">FILL</td><td>F</td><td colspan="4">LV</td></tr>
<tr><td colspan="8">UD</td></tr>
</table>

Figure B-4 Call Accept By GDLP Packet

<table>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>DP=0</td><td>MP=1</td><td colspan="2">SP=1</td><td colspan="2">ST=2</td><td colspan="2">FILL2</td></tr>
<tr><td colspan="2">TC</td><td colspan="6">SN</td></tr>
<tr><td colspan="4">CH</td><td colspan="4">AM</td></tr>
<tr><td colspan="8">AG</td></tr>
<tr><td colspan="8">CC</td></tr>
<tr><td colspan="8">DC</td></tr>
<tr><td>S</td><td colspan="2">FILL</td><td>F</td><td colspan="4">LV</td></tr>
<tr><td colspan="8">UD</td></tr>
</table>

Figure B-5 Clear request by ADLP Packet

<table>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>DP=0</td><td>MP=1</td><td colspan="2">SP=1</td><td colspan="2">ST=2</td><td colspan="2">FILL</td></tr>
<tr><td colspan="2">TC</td><td colspan="6">SN</td></tr>
<tr><td colspan="4">CH</td><td colspan="4">AM</td></tr>
<tr><td colspan="8">AG</td></tr>
<tr><td colspan="8">CC</td></tr>
<tr><td colspan="8">DC</td></tr>
<tr><td>S</td><td colspan="2">FILL</td><td>F</td><td colspan="4">LV</td></tr>
<tr><td colspan="8">UD</td></tr>
</table>

Figure B-6 Clear Request by GDLP Packet

1	2	3	4	5	6	7	8
DP=0	MP=1	SP=1		ST=3		FILL2	
TC		SN					
CH				AM			
AG							

Figure B-7 Clear Confirmation by ADLP Packet

1	2	3	4	5	6	7	8
DP=0	MP=1	SP=1		ST=3		FILL	
TC		SN					
CH				AM			
AG							

Figure B-8 Clear Confirmation by GDLP Packet

1	2	3	4	5	6	7	8
DP=1	M	SN					
FILL1							
PS				PR			
CH				LV			
UD							

Figure B-9 Data Packet

1	2	3	4	5	6	7	8
DP=0	MP=1	SP=3		ST=1		FILL2	
S	F	SN					
CH				LV			
UD							

Figure B-10 **Interrupt Packet**

1	2	3	4	5	6	7	8
DP=0	MP=1	SP=3		ST=3		SS=0	
FILL2		SN					
CH				FILL			

Figure B-11 **Interrupt Confirmation Packet**

1	2	3	4	5	6	7	8
DP=0	MP=1	SP=3		ST=3		SS=1	
FILL2		SN					
CH				PR			

Figure B-12 **Reject Packet**

<table>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>DP=0</td><td>MP=1</td><td colspan="2">SP=2</td><td colspan="2">ST=0</td><td colspan="2">FILL2</td></tr>
<tr><td colspan="2">FILL</td><td colspan="6">SN</td></tr>
<tr><td colspan="4">CH</td><td colspan="4">PR</td></tr>
</table>

<u>Figure B-13</u> Receive Ready Packet

<table>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>DP=0</td><td>MP=1</td><td colspan="2">SP=2</td><td colspan="2">ST=1</td><td colspan="2">FILL2</td></tr>
<tr><td colspan="2">FILL</td><td colspan="6">SN</td></tr>
<tr><td colspan="4">CH</td><td colspan="4">PR</td></tr>
</table>

<u>Figure B-14</u> Receive Not Ready Packet

<table>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>DP=0</td><td>MP=1</td><td colspan="2">SP=2</td><td colspan="2">ST=2</td><td colspan="2">FILL2</td></tr>
<tr><td colspan="2">FILL</td><td colspan="6">SN</td></tr>
<tr><td colspan="4">CH</td><td colspan="4">FILL</td></tr>
<tr><td colspan="8">RC</td></tr>
<tr><td colspan="8">DC</td></tr>
</table>

<u>Figure B-15</u> Reset Request Packet

<table>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>DP=0</td><td>MP=1</td><td colspan="2">SP=2</td><td colspan="2">ST=3</td><td colspan="2">FILL2</td></tr>
<tr><td colspan="2">FILL</td><td colspan="6">SN</td></tr>
<tr><td colspan="4">CH</td><td colspan="4">FILL</td></tr>
</table>

<u>Figure B-16</u> Reset Confirmation Packet

1	2	3	4	5	6	7	8
DP=0	MP=1	SP=3		STO=0		OF	IN
RTL							
RT							
ODL							
OD							

Figure B-17 Route Packet

1	2	3	4	5	6	7	8
DP=0	MP=1	SP=3		ST=2		FILL2	
LENGTH							
FIRST PACKET							
LENGTH							
LAST PACKET							
LENGTH = 0							

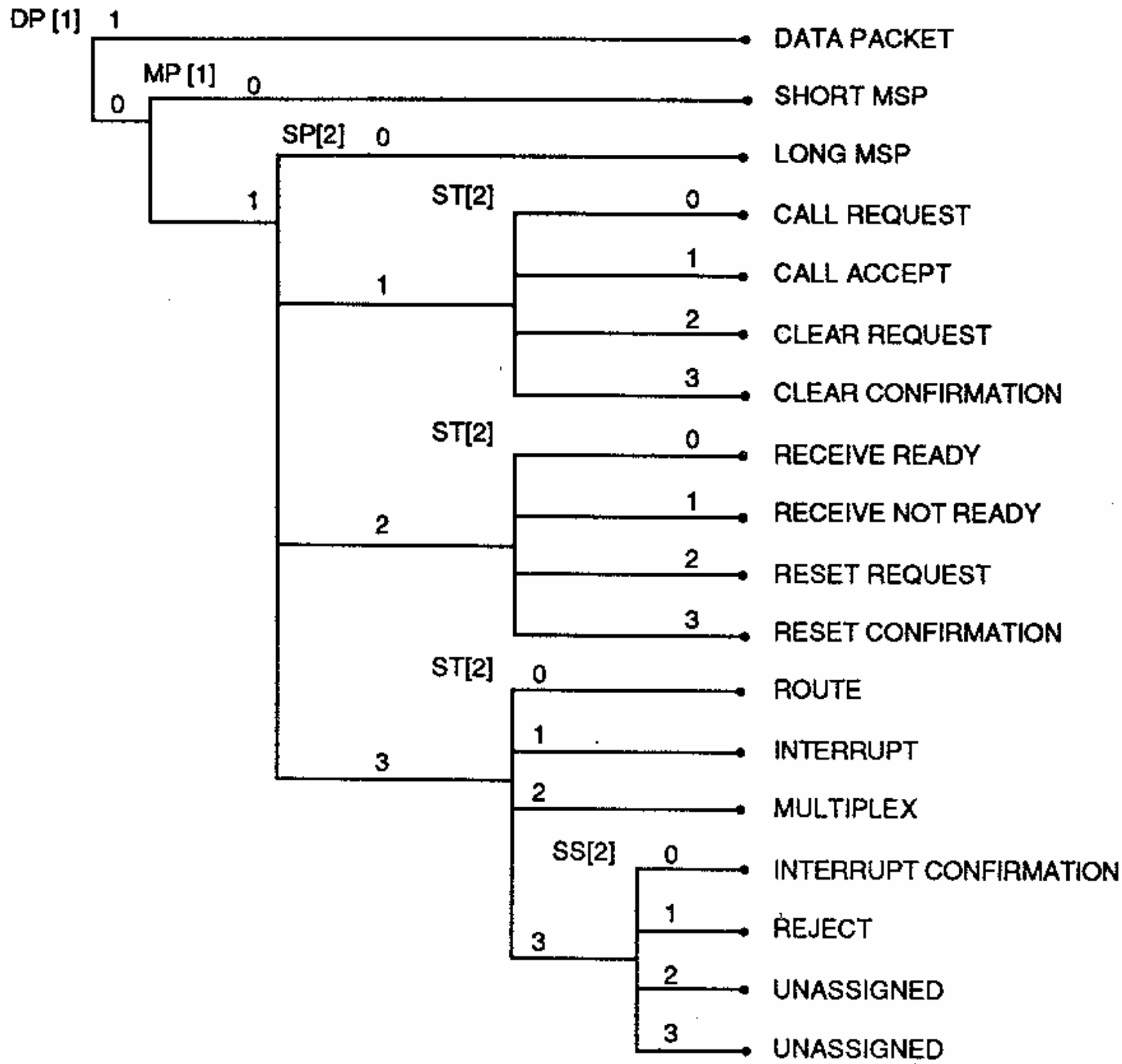
Figure B-18 Multiplex Packet

1	2	3	4	5	6	7	8
DP=0	MP=0	M/CH					
FILL 1							
UD							

Figure B-19 Short Form MSP Packet

<table>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>DP=0</td><td>MP=1</td><td colspan="2">SP=0</td><td>L</td><td colspan="3">M/SN</td></tr>
<tr><td colspan="2">FILL2</td><td colspan="6">M/CH</td></tr>
<tr><td colspan="8">UD</td></tr>
</table>

Figure B-20 Long Form MSP Packet



NOTE:

DP = DATA PACKET TYPE

MP = MSP PACKET TYPE

SP = SUPERVISORY PACKET

ST = SUPERVISORY TYPE

SS = SUPERVISORY SUBSET

Figure B-21 Control Fields Used in MODE S Packets

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Appendix C

GLOSSARY

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Appendix C – GLOSSARY

Aeronautical Telecommunication Network (ATN). An internetwork architecture that allows ground, air/ground and avionic data subnetworks to interoperate by adopting common interface services and protocols based on the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) reference model.

ATN Router. An intermediate system used to interconnect subnetworks conforming to the OSI protocol architecture. It is a special form of gateway in which only the lower three layers need to be implemented to achieve interconnection.

Air-Initiated Protocol. A procedure initiated by a Mode S aircraft installation for delivering a standard length or extended length downlink message to the ground.

Aircraft Address. A twenty-four bit number uniquely assigned to each aircraft carrying a Mode S transponder or other data link installation. (The numbers consisting of twenty-four consecutive ZEROs or twenty-four consecutive ONEs are excluded).

Aircraft Data Circuit-Terminating Equipment (ADCE). An, aircraft specific Data Circuit-Terminating Equipment that is associated with an Aircraft Data Link Processor (ADLP). It operates a protocol unique to Mode S data link for data transfer between air and ground.

Aircraft Data Link Processor (ADLP). An aircraft-resident processor that is specific to a particular air/ground data link (e.g. Mode S), and which provides channel management, and segments and/or reassembles messages for transfer. It is connected on one side (by means of its DCE) to aircraft elements common to all data link systems, and on the other side to the air/ground link itself.

Aircraft Identification. The aircraft identification as specified in Item 7 of the ICAO flight plan.

Binary "ONE". The affirmative value of a binary bit.

Binary "ZERO". The negation value of a binary bit.

Capability Report. Provides an indication of whether the transponder has a data link capability as reported in the capability (CA) field of an all-call reply or squitter transmission (see "Data Link Capability Report").

Closeout. A command from a Mode S interrogator that terminates a Mode S link layer communication transaction.

Cluster of Interrogators. Two or more interrogators with the same Interrogator Identifier (H) code, operating cooperatively to ensure that there is no interference to the required surveillance and data link performance of each of the interrogators, in areas of common coverage.

Comm-A. A 112-bit interrogation containing the 56-bit MA message field. This field is used by the uplink SLM and broadcast protocols.

Comm-B. A 112-bit reply containing the 56-bit MB message field. This field is used by the downlink SLM, ground-initiated and broadcast protocols.

Comm-B Data Selector (BDS). A codes used to specify a desired ground-initiated Comm-B register.

Comm-C. A 112-bit interrogation containing the 80-bit MC message field. This field is used by the extended length uplink ELM protocol.

Comm-D. A 112-bit reply containing the 80-bit MD message field. This field is used by the extended length downlink ELM protocol.

Connection. A logical association between peer-level entities in a communication system.

Data Circuit-Terminating Equipment (DCE). A peer entity of Data Terminal Equipment (DTE) controlled by a data communications network.

Data Link Capability Report. Information in a Comm-B reply identifying the complete Mode S communications capabilities of the aircraft installation.

Data Link Layer. Layer 2 of the OSI reference model, which manages the operations of the physical layer (layer 1) and may utilize special error detection or retransmission techniques to achieve acceptable error rates.

Data Terminal Equipment (DTE). A digital data transmitter/receiver device, such as a terminal or computer.

Downlink. A term referring to the transmission of data from an aircraft to the ground. Air-to-ground Mode S signals are transmitted on the 1090 MHz reply frequency channel.

End System. An end system contains all seven OSI layers and contains one or more end user application processes.

Entity. An active element in any layer which can be either a software entity (such as a process) or a hardware entity (such as an intelligent 1/0 chip).

Extended Length Message (ELM). A series of Comm-C interrogations (Uplink ELM) transmitted without the requirement for intervening replies, or a series of Comm-D replies (Downlink ELM) transmitted without intervening interrogations.

> Uplink ELM (UELM). A term referring to extended length uplink communication by means of 112-bit Mode S Comm-C interrogations, each containing the 80-bit Comm-C message field (MC).
>
> Downlink ELM (DELM). A term referring to extended length downlink communication by means of 112-bit Mode S Comm-D replies, each containing the 80-bit Comm-D message field (MD).

Fast Select. An ISO 8208 facility that permits the transfer of user data with certain control messages.

Field. A defined number of contiguous bits.

Flow Control. A function which controls the flow of data to perform buffer management within a layer or between adjacent layers.

Frame. The basic unit of transfer at the link level. In the context of this standard, a frame can include from one to four Comm-A or Comm-B segments, from two to sixteen Comm-C segments, or from one to sixteen Comm-D segments.

Global Positioning System (GPS). A global navigation system based upon a constellation of satellites.

Ground Data Circuit-Terminating Equipment (GDCE). A ground specific Data Circuit-Terminating Equipment associated with a Ground Data Link Processor (GDLP). It operates a protocol unique to Mode S data link for data transfer between air and ground.

Ground Data Link Processor (GDLP). A ground-resident processor that is specific to a particular air/ground data link (e.g. Mode S), and which provides channel management, and segments and/or reassembles messages for transfer. It is connected on one side (by means of its DCE) to ground elements common to all data link systems, and on the other side to the air/ground link itself.

Ground-Initiated Protocol. A procedure initiated by a Mode S interrogator for delivering standard length or extended length messages to a Mode S aircraft installation.

Intermediate System (IS). A system comprising the lower three layers of the OSI reference model used to connect subnetworks to provide connections between end-systems.

International Organization for Standardization (ISO). An international organization that has developed the Open Systems Interconnection (OSI) Model together with protocol standards at various levels of the model. (See also "Open Systems Interconnection.")

Internetwork. A term referring to the interconnection of logically independent heterogeneous subnetworks. The constituent subnetworks are usually administered separately and may employ different transmission media.

Internetwork Function. An entity which performs the relaying and routing functions to enable transmission of messages between subnetworks.

Interrogator Identifier (11). One of the codes (0 to 15) used to identify a Mode S interrogator or cluster of networked interrogators for use in conjunction with the Mode S multisite protocols.

ISO 8208. The International Organization for Standardization (ISO) document, "X.25 Packet Layer Protocol for Data Terminal Equipment" defining a connection-oriented network protocol interface standard that supports Switched Virtual Circuit (SVC) connection services.

Message. Information which is passed by one or more data blocks from one end user to another through one or more subnetworks.

Mode S. An enhanced mode of secondary surveillance radar (SSR) that permits the selective interrogation of Mode S transponders, the two-way exchange of digital data between Mode S interrogators and transponders, and also the interrogation of Mode A/C transponders.

Mode S Air-Initiated Comm-B (AICB) Protocol. A procedure initiated by a Mode S transponder for transmitting a single Comm-B segment from the aircraft installation.

Mode S Broadcast Protocols. Procedures allowing standard length uplink or downlink messages to be received by more than one transponder or ground interrogator respectively.

Mode S Data Link. A means of performing an interchange of digital data through the use of Mode S interrogators and transponders in accordance with defined protocols.

Mode S Ground-Initiated Comm-B (GICB) Protocol. A procedure initiated by a Mode S interrogator for eliciting a single Comm-B segment from a Mode S aircraft installation, incorporating the contents of one of 255 Comm-B registers within the Mode S transponder.

Mode S Interrogator. Ground equipment that interrogates Mode A/C and Mode S transponders using intermode and Mode S interrogations, and performs appropriate processing on the replies.

Mode S Multisite-Directed Protocol. A procedure to ensure that extraction and close-out of a downlink standard length or extended length message is affected only by the particular Mode S interrogator selected by the aircraft.

Mode S Specific Protocol (MSP). A Mode S specific protocol that provides restricted datagram service within the Mode S subnetwork.

Mode S Specific Services. A set of communication services provided by the Mode S system which are not available from other air/ground subnetworks, and therefore not interoperable.

Mode S Specific Services Entity (SSE). An entity resident within an XDLP to provide access to the Mode S specific services.

Mode S Subnetwork. A subnetwork providing air/ground data transmission using the Mode S data link. It consists on the ground side of the Mode S Ground Data Link Processor (GDLP) and the Mode S interrogator, and on the airborne side of the Mode S Aircraft Data Link Processor (ADLP) and the Mode S transponder.

Mode S Transponder. Aircraft equipment that generates specified responses to Mode A/C, intermode and Mode S interrogations.

Network Layer (Layer 3). The layer of the OSI reference model that uses the services of the data link layer, making routing decisions when multiple data link connections are available and segmenting or reassembling the user data as required.

Open Systems Interconnection (OSI). A model of a computer communications architecture, developed by the International Organization for Standardization (ISO), consisting of seven self-contained functional layers.

Packet. The basic unit of data transfer among communications devices within the Network layer.

ISO 8208 Packet. A packet conforming to the definition given by the ISO 8208 standard.

Mode S Packet. A packet conforming to the definition given by this standard, designed to minimize the bandwidth required from the air/ground link. ISO 8208 packets may be transformed into Mode S packets and vice-versa.

Packet Layer Protocol (PLP). A protocol to establish and maintain a connection between peer level entities at the Network layer, and to transfer data packets between them. In the context of this standard, the term refers to the protocol defined by the ISO 8208 standard or this document.

Peer Entity. A term describing an entity communicating with a partner at the same level of the communications hierarchy.

Physical Layer (Layer 1). The layer of the OSI reference model that controls access to the transmission medium that forms the basis for the communication system.

Protocol. A set of rules and formats (semantic and syntactic) that determine the communication behavior between peer entities in the performance of functions at that layer.

Router. See "ATN Router."

Routing. A function within a layer that uses the address to which an entity is attached in order to define a path by which that entity can be reached.

Segment. A portion of a message that can be accommodated within a single MAIMB field in the case of a standard length message, or MC/MD field in the case of an extended length message. This term is also applied to the Mode S transmission containing these fields.

Standard Length Message (SLM). An exchange of digital data using selectively addressed Comm-A interrogations and/or Comm-B replies (see "Comm-A" and "Comm-B").

Subfield. A defined number of contiguous bits within a field. (See "Field").

Subnetwork. An actual implementation of a data network that employs a homogeneous protocol and addressing plan, and is under control of a single authority.

Subnetwork Management Entity (SNME). An entity resident within a GDLP that performs subnetwork management and communicates with peer entities in intermediate or end systems.

Surveillance Interrogation. A 56-bit Mode S interrogation containing surveillance and communications control information.

Switched Virtual Circuit (SVC). The primary circuit management technique provided within the ISO 8208 Protocol. The network resources are dynamically allocated when needed and released when no longer required.

Traffic Alert and Collision Avoidance System (TCAS). An aircraft collision avoidance system that uses Mode S signals for performing surveillance and communication

Timeout. The cancellation of a transaction after one of the participating entities has failed to provide a required response within a pre-defined period of time.

Uplink. A term referring to the transmission of data from the ground to an aircraft. Mode S ground-to-air signals are transmitted on the 1030 MHz interrogation frequency channel.

XDCE. A general term referring to both the Aircraft DCE (ADCE) and the Ground DCE (GDCE).

XDLP. A general term referring to both the Aircraft Data Link Processor (ADLP) and the Ground Data Link Processor (GDLP).

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